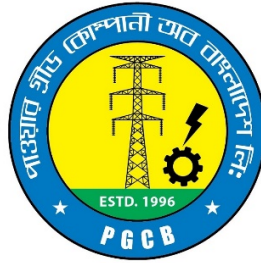


POWER GRID COMPANY OF BANGLADESH LIMITED



BIDDING DOCUMENT

for

**Design, Supply, Erection, Testing &
Commissioning of Upgradation of the Existing
132kV Madunaghat Substation to 230kV GIS
substation on Turnkey Basis**

(Bid Identification No.: PGCB/DCMPGSP/BD-P81/SS/03)

Volume 3 of 3

Employer: Power Grid Company of Bangladesh Limited

Country: The People's Republic of Bangladesh

Project: Dhaka-Chittagong Main Power Grid Strengthening
Project

September 2019

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POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF PACKAGE SS-3 UPGRADATION OF THE EXISTING 132KV MADUNAGHAT SUBSTATION TO 230KV ON TURNKEY BASIS

SCHEDULE A

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

BRIEF DESCRIPTION OF THE WORKS

The bidder shall be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment. All necessary materials, adjustments, dismantling, re-routing, temporary, remedial and tidying-up work in order to complete the work specified shall be included in the contract price. **The contractor is responsible for ensuring that all and/or any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid Price whether they be described in the specification or not.**

The scope of work comprises the following: -

BRIEF DESCRIPTION OF WORKS

The brief description of works under this contract is as follows:

1. Upgradation of the Existing 132kV Madunaghat Substation to 230kV

The scope of works under this turnkey contract is design, supply, delivery, installation, testing & commissioning of outdoor type of new 230kV GIS and 3-phase, 230/132/33kV, 300MVA auto transformers on the existing site of the old 132kV AIS Madunaghat substation.

132kV side of 300MVA transformers will be connected by cable, under this contract, to GIS bays, included in 132/33kV GIS Substation project under the

contract ICB No.: PSEEIP (TRANCHE-3)/ADB/PGCB/P03/SS.

The following is a brief description of the scope of works, and details are described in the subsequent sections of the Bidding Documents.

- 1) Dismantling and removal of the existing 132kV substation equipment and concrete structures in order to free space for construction of 230kV substation
- 2) 230kV GIS Outdoor Switchyard (Double Busbar Scheme)
 - Two (2) overhead transmission line bays to connect one (1) 230 kV double circuit line (Madunaghat-1 & 2)
 - One (1) Bus Coupler Bays
 - Three (3) transformer bays
 - Space for future extension of 4 transmission line GIS bays and 1 transformer bayJointing plugs shall be provided for connecting GIS of different makes;
- 3) Transformer Yard
 - three (3) sets of 3-phase 230/132/33kV, 300MVA auto transformers
 - Space for future extension for one transformer bay
- 4) 132kV GIS Switchyard
 - 132kV cables between the auto transformers and existing 132kV GIS transformer bays in the 132kV GIS Building

The scope of work also includes:

- one (1) of Switchyard Panel Room (SPR) building to accommodate 230kV and 33kV protection and control panels, station AC and DC power facilities and associated equipment,
- extension of existing substation automation in the existing 132kV GIS SS control building,
- extension of existing fiber optic multiplexer equipment for communication & protection in the existing 132kV GIS SS control building,
- digital fault & disturbance recorder (DFDR),
- station AC and DC power facilities,
- towers and gantry structures with relevant accessories
- associated civil works for GIS switchyard,
- local control kiosks, outdoor switchyards cable tunnels and trenches, lighting water supply & sewerage, internal access roads, and all other necessary substation facilities, (Boundary wall, Gates and Guard House are existing).
- supply of mandatory spare parts and maintenance tools.

The “Schedule of Requirements” (schedule A) for equipment, materials and services and the detailed technical specifications of equipment and materials of the Bidding Documents shall be read in conjunction with the scope of work described herein. The drawings provided in the Bidding Documents are indicative only and hence the entire scope of work is not fully reflected in those drawings.

The Programme of Works shall be as shown in Schedule C of “Times for Delivery and Completion”. Within one month of the signing of the Contract, the Contractor shall submit a programme chart detailing times required for the design,

manufacture, testing, delivery and erection for the complete contract.

The Contractor is responsible for ensuring that all and any items of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid price whether they be described in the Specifications or not.

2. Training and Inspection:

The Contract Price shall include all costs of training & inspection of Employers and the instruction of staffs on site for the following:

- (a) Overseas International Training: the following engineers/officials nominated by the Employer shall be provided with training by a specialist at manufacturers' works as follows:
- Contractor shall arrange training on Financial Management for four PGCB officials in reputed independent training institute for relevant training outside Employer's country for 14 days.
 - Contractor shall arrange training on Project Management for four PGCB Engineers in reputed independent training institute for relevant training outside Employer's country for 14 days.
 - Contractor shall arrange training on Procurement Management for four PGCB Engineers in reputed independent training institute for relevant training outside Employer's country for 14 days.
- (b) International Witnessing: the following engineers nominated by the Employer shall participate in the inspection and witnessing of factory acceptance tests at manufacturers' works as follows:

SN	Description	No/ engineer	Consultant	Duration (working Days excluding travel time)
1	Transformers	2	1	12
2	GIS	2	1	12

- (c) Local Training: On-site instruction by the manufacturer's engineer on operations and maintenance of the (i) Substation facilities including HV Gas Insulated Switchgears & transformers (ii) protection & Substation automation system (iii) fiber optic multiplexer & digital PABX for a period of two (2) weeks and for fifteen (15) PGCB engineers in each program.

The Contractor shall be responsible for bearing all costs for the trainees (for item (a)), including but not limited to air fares, accommodation, meal, healthcare, transportation, visa fees together with payment of a daily allowance of US\$ 90 for each of the Employer's trainee.

The Employer's engineer & consultant attending the Pre-shipment inspection (as mentioned in item (b) International Witnessing) shall be provided with the same facilities except the payment of daily allowance which is to be US\$ 100.

3. Employer's Engineer's Site Office

The Contractor shall provide office accommodation as per clause 12.1.9 of Section 12 of Volume 2 of 3 in the Bidding Documents during the Contract period. The Employer's Engineer's Office at site shall be arranged by the contractor, either in a separate temporary building or in the existing old 132kV Control Room Building which will be

out of service except some 33kV control facilities.

All equipment mentioned in the clause 12.1.9, except 3 bedrooms shall be provided. The existing facilities and rooms in the existing old 132kV Control Room Building shall be refurbished for this purpose. Missing facilities shall be provided. Security guard services for the Employer's Engineer's Office and car parking for three (3) vehicles will not be required because they already exist.

This Bidding Documents are for the design, manufacture, quality assurance, new packing for export, insurance, shipment, custom clearance, inland transportation to site, complete construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning including civil work and building services, warranty for a period of three-hundreds and sixty-five (365) days for all equipment, including all civil works.

SCHEDULE A

REQUIREMENTS

Section-I 230/132kV GIS Substation

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings (Volume 2 of 3):

Item	Description
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1A	Deleted
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1B	230kV GIS Switchyard
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As shown on the bid drawings, gas-air bushings and gas insulated lines (GAB/GIL) shall be applied for connection between the 230kV gantry and 230kV GIS.

245kV Outdoor Type Gas Insulated Switchgear (GIS)

The 245kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A to this section and shall comprise the followings:

Item No	Quantity	Requirements
230kV Outdoor Type Gas Insulated Switchgear (GIS)		
1B1	Two (2) Nos.	of 245kV GIS Line Feeder Bays, each comprising:
	1 Lot	245kV, 4000A, 50kA/3s, three phase double busbar
	2 Sets	245kV, 4000A, 50kA/3s, three phase busbar disconnector complete with motor operating mechanism
	2 Sets	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB
	1 Set	245kV, 4000A, 50kA/3s, three phase, single pole operation circuit breaker complete with spring-stored energy operating mechanism
	3 Nos.	245kV, 4000A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 4000/1A, Class X for Busbar Differential Protection and Breaker Failure - 4000/1A, Class X for Spare - 4000/1A, Class 0.2 for Metering 1
	3 Nos.	245kV, 4000A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 4000/1A, Class 5P20 for Main 1 Protection - 4000/1A, Class 5P20 for Main 2 Protection - 4000/1A, Class 5P20 for BCU & DFDR
	1 Set	245kV, 4000A, 50kA/3s three phase line disconnector integral with high speed earth switch complete with motor operating mechanism
	3 Nos.	245kV single phase voltage transformer with windings as follows: - $230,000/\sqrt{3}:110/\sqrt{3}:110/\sqrt{3}$ V, Class 0.2 for Metering and Class 3P for Protection

	1 Lot	1 Lot 245kV Gas Insulated Line (GIL) with terminating bushings, complete with support
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel as appropriate
	1 No.	Local Control Panel
1B2	Three (3) Nos. of 245kV GIS Auto Transformer Feeder Bays, each comprising:	
	1 lot	245kV, 4000A, 50kA/3s, three phase double busbar
	2 Sets.	245kV, 1600A, 50kA/3s, three phase busbar disconnecter complete with motor operating mechanism
	2 Sets	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB
	1 Set	245kV, 1600A, 50kA/3s, three phase, single pole operation circuit breaker complete with spring-stored energy operating mechanism
	3 Nos.	245kV, 1600A, 50kA/3s, single phase, 3-core, current transformer with cores as follows: - 1600/1A, Class X for Busbar Differential Protection and Breaker Failure - 1600/1A, Class 5P20 for Spare - 1600/1A, Class 0.2 for Metering
	3 Nos.	245kV, 1000A, 50kA/3s, single phase, 3-core, current transformer with cores as follows: - 1600/1A, Class 5P20 for Main 1 Protection - 1600/1A, Class 5P20 for Main 2 Protection and Transformer Differential - 1600/1A, Class 5P20 for BCU & DFDR
	1 Sets	245kV, 1600A, 50kA/3s, three phase line disconnecter complete with motor operating mechanism
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for single-core cables, busbar end covers or link to adjacent switchgear panel as appropriate
	1 No.	Local Control Panel
1B3	One (1) Nos. of 245kV Bus Coupler Bays , each comprising:	
	1 lot	245kV, 4000A, 50kA/3s, three phase double busbar
	2 Sets	245kV, 4000A, 50kA/3s, three phase busbar disconnecter complete with motor operating mechanism
	2 Sets	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism, one (1) on either side of circuit breaker.
	1 Set	245kV, 4000A, 50kA/3s, three phase, single pole operation circuit breaker complete with spring-stored energy operating mechanism
	3 Nos.	245kV, 4000A, 50kA/3s, single phase, 2-core, current transformer with cores as follows: - 4000/1A, Class X for Busbar Differential Protection - 4000/1A, Class 0.2 for Metering
	3 Nos.	245kV, 4000A, 50kA/3s, single phase, 2-core, current transformers with cores as follows: - 4000/1A, Class X for Busbar Differential Protection and Breaker Failure Protection - 4000/1A, Class 5P20 for BCU & DFDR
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel as appropriate
	1 No.	Local Control Panel

1B4	One (1) Nos. of 245kV GIS Double Busbar with VT/ES, comprising:	
	1 lot	245kV, 4000A, 50kV/3s, three phase double busbars
	6 Nos.	245kV single phase voltage transformer with windings as follows: - 230,000/ $\sqrt{3}$:110/ $\sqrt{3}$:110/ $\sqrt{3}$, Class 0.2 for Metering and Class 3P for Protection
	2 Sets	245kV, 50kA/3s, three phase earth switches complete with motor operating Mechanism
	1 No.	Local Control Panel

245 kV Air Insulated Switchgear (AIS)

- 1B5 fifteen (15) nos. of 196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters.
- 1B6 Eighteen (18) nos. of 230kV post insulators to be installed between auto transformers and 230kV GIS transformer bays air terminations.
- 1B7 One (1) lot of rigid tubular bus and/or stranded conductors including accessories for each connection as required for completing 230kV GIS Switchyard
- 1B8 One (1) lot of insulator and fittings including all necessary clamps and connectors as required for completing 230kV GIS Switchyard
- 1B9 One (1) lot of steel gantry for one (1) double circuit of 230kV Transmission Line including all necessary accessories required for completing 230kV GIS Switchyard
- 1B10 One (1) lot of steel supports for surge arrestors and post insulators, including nuts & bolts and all necessary accessories required for completing 230kV GIS Switchyard

1C 132kV Autotransformer to 132kV GIS Connections

- 1C1 nine (9) sets of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters
- 1C2 1600 m of 132kV power cables for connection between 132kV GIS and three (3) sets of 230/132/33kV Auto Transformers including all necessary accessories. One spare cable shall be laid with coiled ends of sufficient length to enable connection to any of the 3 auto transformers. The total length of cable is estimated and included in price schedule. Actual length shall be defined during execution stage and paid by the unit price stated in the bid.
- 1C3 Nine (9) sets of 132kV outdoor cable termination for the above cable
- 1C4 Nine (9) sets of 132kV GIS cable termination for the above cable
- 1C5 One (1) lot of rigid tubular bus and/or stranded conductors including accessories for of connection of 132kV cables to autotransformers and surge arresters

1C6	One(1) lot of steel structures for equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV circuits.
1D	36kV Switchgears and Connections with Auto Transformer & Earthing / Auxiliary Transformers
	Deleted
1E	Power Transformers
1E1	Deleted
1E2	Three (3) nos. of 230/132/33 kV, 235/300 MVA (ONAN/ONAF), three phase outdoor type auto transformer, equipped with the delta connected 33 kV tertiary winding (brought out to terminal bushings)
1E3	Nitrogen injection Fire protection system for three (3) 230/132/33KV Auto transformers complete One (01) lot .
1F	Control, Protection, Substation Automation & Metering
	230 kV Circuits
	The existing Substation Automation System supplied by ABB Switzerland Ltd SAS650 Series (located in 132kV GIS SS Control Room) shall be extended to accommodate SAS requirements for 230kV substation under this contract. The connection of SAS in 132kV Control Room with 230kV control and protection panels in SPR Building shall be through fiberoptic cables. The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:
1F1	Control, Monitoring, Protection & Substation Automation System including event recording function for two (2) sets of overhead line circuits to Madunaghat 1&2. Main line differential protection relays shall be of the same manufacturer type as those provided for 400/230kV Madunaghat substation.
1F2	Control, Monitoring, Protection & Substation Automation System including event recording function for three (3) sets of 230/132/33kV, three-phase, power auto transformer circuits including transformer tap changer control, fan control & AVR as per 4.15 of section 4 and 5.12.12 of section 5 in volume 2 of 3
1F3	Control, Monitoring, Protection & Substation Automation System including event recording function for one (1) set of bus coupler bays
1F4	One (1) set of Busbar protection for 230kV system.
1F5	Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVArh meter (accuracy class 0.2) for each 230kV line and transformer feeder. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed

catalogue, operation and service manual are to be provided.

- 1F6 Independent standalone Digital Fault and Disturbance recorder (DFDR) with Main Control Unit located in 132kV GIS building Control Room and Acquisition Unit in SPR Building for monitoring all 230kV GIS circuits and 230/132/33kV auto transformers.

Note: Only on/off monitoring of ES and measuring of bus PT shall be integrated with SAS within the contract price.

132 kV Circuits Not Applicable - Included in 132kV SS contract

33kV Station Power System

- 1F8 Deleted

1G Multicore LV Cables

- 1G1 One(1) lot complete set of multicore low voltage XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided.

1H Earthing and Lightning Protection

- 1H1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

- 1H2 Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fiber operating pole suitable for plant supplied. (230kV and lower voltages)

I Batteries, Chargers and DC Distribution

- 1I1 110V substation NiCad battery complete with charger and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment.

The system shall generally be as shown in bid drawing and shall include:

- i. One (1) set of 100% battery capacity shall not be less than 150 Ah at the 5-hour rate of discharge

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per clause 8.4.3 of section 8 of Volume 2 of 3 of the bidding document. The battery with higher capability if required after calculation shall be supplied within the same price.

- ii. One (1) 110V battery charger complete, with rating not less than 50A and input voltage three phase 50Hz, 415V AC

The rating shall be based on the load and boost charging rate. The higher rate charger shall be supplied within the same price if required after calculation.

- iii. One (1) 110V DC distribution board with additional supply from 132kV GIS substation existing 110V DC distribution board. The required outgoing feeder breakers and cables shall be installed in the existing DC distribution board in 123kV SS GIS building in accordance with the bid drawing. The additional 110V DC supply from existing source shall be used for tripping coils No.2 of 230kV GIS circuit breakers. The new 110VDC supply shall be used for 230kV CB trip coils No.1 and other DC loads, during normal operation.

The DC distribution board shall be with 25% overall spare switches for future use.

The battery and the battery charger shall be located in switchyard panel room (SPR).

All DC status excluding control & protection (DC voltage status for bus including incoming breaker from 132kV SS DB on /off status, fail with alarm) shall be incorporated in substation automation system.

1I2 Deleted: (48V DC system included in 132kV SS contract)

1J LVAC Distribution

- 1J1 One (1) lot of LVAC switchboard for 230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The power supply shall be from 132kV GIS substation LVAC distribution board. The required outgoing feeder breaker and cable shall be installed in the existing LVAC distribution board in 123kV SS GIS building in accordance with the bid drawing.

All AC status (AC current, voltage and kWh) and incoming breaker on/off status (with fault and alarm), excluding control & protection, shall be incorporated in substation automation system.

- 1J2 Deleted: Tariff metering panel for LVAC (Included in 132kV SS)

1K Civil Works, Building and Foundation

The Contractor has to prepare the proposed switchyard area by filling / cutting soil and leveling up to finished level and within property line suitable for 230kV GIS switchyards and Transformer yard which shall be same level with the adjacent new 132/33kV Transformer yard. The price of these work shall be deemed to be included in the overall Contract price.

- 1K1 Identification and relocation control and protection cables for existing 33kV feeders if found in the area of proposed 230kV switchyard.

- 1K2 Dismantling and removal of the existing 132kV substation equipment and concrete structures in order to free space for construction of 230kV substation.

Note: The contractor jointly with PGCB's representative shall make a list before dismantling. After dismantling, all removed equipment Cables, clamp/connector, gantry, equipment structure shall be returned to PGCB's designated store in Chattogram area as per instruction of project engineer. Removed concrete and other wastages shall be transferred from site by the contractor. It may be considered that Contractor can earn money from sale of removed concrete and other wastages and accordingly they may consider it in their overall quoted price.

- 1K3 One (1) lot of complete design, supply and construction of all civil works, including 230kV gantry and equipment foundations, power transformers foundations, oil pit, blast walls, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trenches including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing. The cable trenches for HV cables connected to 132kV GIS and control cables shall be constructed up to the 132kV GIS Building. The passage under the road will be through 150mm diameter PVC pipes (quantity 15).

- 1K4 One (1) lot of complete design, supply and construction of all civil items and facilities required for Switchyard Panel Room (SPR) building, to install all control and protection panels including ACDB, battery & charger, etc.

- 1K5 One (1) lot of complete design, supply and construction of fire alarm & firefighting system for SPR and 230kV Switchyard except Transformer yard. Fire extinguishers shall be supplied as per section 12.7 of Volume 2 of 3, for switchyard panel room and outdoors.

1L Lighting, Small Power, Air Conditioning and Ventilation

- 1L1 One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the SPR Building.

- 1L2 One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection.

1M Fibre Optic Multiplexer Equipment for Communication and Protection

- 1M1 Multiplexer:

The existing Fibre Optic Multiplexer supplied by ABB Switzerland Ltd, type FOX615 Series shall be extended to accommodate Communication and Protection requirements for 230kV substation under this contract. The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.

One (1) lot of complete set of design, supply, installation and commissioning of equipment necessary for extension of existing fiber optic multiplexer equipment, installed in 132kV GIS SS Control Building, covering Madunaghat 230kV substation optical interfaces with necessary works to interface with existing

system is to be provided for:

- 87 and 21 relays for each transmission line protection (through fiber cores)
- SCADA data from switchgear and control system through SAS
- Hot-line telephone system
- Substation LAN system

Additionally, if any Optical Interfaces are required for system configuration at each remote end substation, then interface devices shall be installed in each existing system.

1M2 PABX:

Extension of existing 132kV substation digital PABX with subscriber telephone sets for the complete 230kV substation including necessary works to interface with existing system.

1M3 Optical Fiber:

Underground optical fiber cables (48 cores for 230kV) from terminal box on gantry of 230kV double circuit transmission line termination point to ODF (Optical Distribution Frame) to be installed in existing 132kV GIS Control Building communication room. The Contract includes supply and installation of ODF and pigtail cables with adequate length.

1N SCADA system for Telecontrol and Telemetry

1N1 One (1) lot of complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to extend the existing equipment (in 132kV GIS Control Building) for the telecontrol & telemetry facilities required at the existing National Load Dispatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new 230kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. One more Industrial Gateway shall be installed and configured as hot stand-by. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out.

Section-II Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment to be supplied under this project shall be from Europe, USA, Japan or equivalent origin. The materials shall have to be handed over to the designated store as per instruction of the Employer.

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APPENDIX SCHEDULE OF TECHNICAL REQUIREMENTS

A1	
A1-1	230kV GAS INSULATED SWITCHGEAR (GIS)
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A10	DIGITAL FAULT AND DISTURBANCE RECORDER [DFDR]
A11	CCTV DURING SITE WORKS

APPENDIX A1 A1-1

SCHEDULE OF TECHNICAL REQUIREMENTS OF 230kV GAS INSULATED SWITCHGEAR (GIS)

A1-1 230kV GAS INSULATED SWITCHGEAR AND ASSOCIATED EQUIPMENT

Sl. No.	Description	Unit	Data
1.	Site Condition		
	Max. altitude above sea level	m	not more than 1000
	Max. ambient temperature, outdoor	°C	+45
	Min. ambient temperature, indoor	°C	+4
	Max. ambient relative humidity	%	100
	Max. seismic acceleration at floor level		
	- horizontal	g	0.15
	- vertical	g	0.15
2.	Type designation		
	Enclosure:		
	Bus bar		Three phase/single phase
	Bay		Single phase
	Enclosure material		Al
	Standard		IEC
3.	Electrical data		
	Rated Voltage	kV	245
	Rated Frequency	Hz	50
	Insulation Level:		
	- lightning impulse withstand voltage	kV	1050
	- power frequency withstand voltage	kV	460
	Rated continuous current at 40 °C ambient temperature:		
	- main busbar	A	4000
	- bus section / coupler	A	4000
	- line bay	A	4000
	- transformer bay	A	1600
	Rated short time withstand current for 3 sec. (rms)	kA	50
	Rated peak withstand current (peak)	kA	125
4.	Secondary circuits		
	Auxiliary voltages:		
	- for controlling and signalling	V d.c.	110
	- for remote control	V d.c.	110
	- for heating	V a.c.	415 /240
	- tolerance	%	-15 / +10
5.	Solid insulator		
	Type of solid insulator		Disc type

	Material of solid insulator		Epoxy cast resin
	Discharge level at 110% of the rated voltage	pC	10
6.	Insulation medium		
	Insulation medium		SF6
	Max. permissible moisture content	ppm	700
	Max. permissible air content	vol %	10
7.	Gas compartments		
	Max. gas losses per gas compartment and year		less than 0.1%
	Min. operating period to 1 recharge of SF6 gas	year	10
	Material of filter employed for moisture absorption		Al2O3
	Type of gas monitoring		Density monitor
	Type of pressure relief device		Rupturing diaphragm
	Material of pressure relief device		Ni-Fe
8.	Enclosure		
	Temperature rise of enclosure at rated current		
	- which have to be touched during operation	°C	Max. 30
	- which need not to be touched during operation	°C	Max. 40
	- which are not accessible to the operator	°C	Max. 65
9.	Circuit breaker		
	Enclosure		Single phase
	Enclosure material		Al
	Material of Contacts		Silver plated copper
	No. of breaks per phase	pcs.	1
	Percentage of d.c. component	%	50
	First-pole-to-clear-factor		1.3
	Rated breaking current, small capacitive currents		
	- line charging	A	250
	- cable charging	A	160
	capacitor bank	A	160
	Rated breaking current, small inductive currents		
	- unloaded transformers	A	25
	- transformer loaded with reactor	A	> 200
	shunt reactors	A	> 250
	Switching overvoltage	p.u.	2.5
	Operating Mechanism		
	Auto reclosure (for Line CB)		Single / Three phase
	Operating mechanism		
	- for closing & opening		Spring
	Making coil		
	- number per operating mechanism	pcs.	1

Tripping coil			
- number per operating mechanism	pcs.	2	
- voltage tolerance	%	-30 / +10	
Rated motor voltage	V d.c.	110	
Auxiliary contacts			
- number (NC / NO / wiping)	pcs.	12 / 12 / 2	
Rated duty cycle		O-0.3sec-CO-3min-CO	
Max. closing time	ms	65	
Max. dead time	ms	300	
Max. break time	ms	65	

10. Disconnecter

Enclosure			Three phase
Enclosure material			Al
No. of breaks in series (per phase)	pcs.	1	
Rated breaking current (capacitive)	A	2.0	
Operating mechanism			
- for closing			Motor
- for opening			Motor
Max. operating time			
- for closing	sec	5.0	
- for opening	sec	5.0	
Auxiliary contacts			
- number (NC / NO)	pcs.	12 / 12	
Rated motor voltage	V d.c.	110	
Hand operating facilities			Yes

11. Maintenance earthing switch

Enclosure			Three phase gang operation
Enclosure material			Al
Operating mechanism			
- for closing			Motor
- for opening			Motor
Max. operating time			
- for closing	sec	5.0	
- for opening	sec	5.0	
Auxiliary contacts			
- number (NC / NO)	pcs.	6 / 6	
Rated motor voltage	V d.c.	110	
Hand operating facilities			Yes

12. High speed earthing switch

Enclosure			Three phase gang operation
Enclosure material			Al
Operating mechanism			

	- for closing - for opening		Spring Motor charged
	Max. charging time	sec	6
	Max. operating time		
	- for closing	ms	60
	- for opening	sec	7
	Auxiliary contacts		
	- number (NC / NO / wiping)	pcs.	6 / 6 / 2
	Rated motor voltage	V d.c.	110
	Hand operating facilities		Yes

13. Gas insulated current transformer (Ring core type)

	Ratio		
	- bus section/coupler, line bay	A	4000 / 1
	- transformer bay	A	1600 / 1
	Core for protection:		
	- Rated output	VA	30
	- Accuracy class		5P20
	Core for metering:		
	- Rated output	VA	30
	- Accuracy class		0.2
	Core for busbar protection:		
	- Rated output	VA	30
	- Accuracy class		X or 5P20

14. Gas insulated voltage transformer

	Secondary voltage	kV	$0.11/\sqrt{3}$ / $0.11/\sqrt{3}$
	Total burden	VA	30 / 30
	Accuracy class		3P / 0.2

A1-2

SCHEDULE OF TECHNICAL REQUIREMENTS OF 230kV AIR INSULATED SWITCHGEAR (AIS)

1. Surge arrestors

Type		Outdoor type, ZnO, Gapless
Rated voltage	kV	196
Max. continuous operating voltage	kVrms	160
Nominal discharge current	kA	10
Discharge class		Heavy duty 3
Surge counter		Yes
Leakage current detector		Yes

APPENDIX A2
A2-1

SCHEDULE OF TECHNICAL REQUIREMENTS OF
230/132/33 kV AUTO TRANSFORMER

Sl.No	Description	Unit	Required Data
	RATING AND PERFORMANCE		
1	Maximum continuous rating (MCR)	MVA	300
2	Number of Phases		3
3	Number of windings		Auto plus stabilising
4	Normal ratio of transformation at no load and at principle tap - HV/LV/TV	kV	230/138/34.5
5.1	Corresponding highest system voltages	kV	245/145/36
5.2	Corresponding lowest system frequency	Hz	48
6	Minimum withstand voltages:		
	- Full wave impulse withstand of windings	kVp	1050 /650 /170
	- Full wave impulse withstand of line terminal bushings	kVp	1050 /650 /170
	- Induced over voltage	kV rms	460 /275 /70
	- Power frequency withstand of neutral	kV rms	38
7	Type of cooling		ONAN/ONAF
8	Minimum continuous rating	MVA	225/300
9	Rating of tertiary windings	MVA	75/100
10	Service conditions:		
	- External cooling medium	-	Air
	- Altitude not exceeding	m	150
	- Air temperature not exceeding	°C	42
	Average air temperature in any one year not exceeding:		
	- In any one day	°C	35
	- Average in one year	°C	25
11.1	Maximum temperature :		
	- Top oil rise normal	°C	50
	- Average ONAN winding rise	°C	55
	- Average ONAF winding rise	°C	55
11.2	Maximum hot spot temperature at maximum continuous rating at yearly average ambient temperature	°C	98
11.3	Winding hot spot temperature on emergency overload not exceeding	°C	110
12	Phase connections:		
	- HV winding		Star
	- LV winding		Star
	- TV winding		Delta

13	- Vector group - HV/LV/TV Short circuit withstand fault level at terminals of: - 230 kV busbars - 132 kV busbars - 33kV busbars	kA kA kA	YNa0d1 50 50 31.5
14	Impedance voltage at 75°C and at normal tap and MCR (at 300MVA) between windings (% on HV Base): - HV & LV % on HV base	%	13
15	Delta connected tertiary winding - Nominal voltage - External load	kV kVA	33 0
16.1	Total range of variation of on load transformation ratio (on HV side) as sl. nos. 4: - Ratio - Size of steps	% %	±10 1.25
16.2	Type of control		On load local, remote and supervisory electrical and hand operation
17	Line drop compensation		Yes
18	Whether automatic control required and referenced voltage		Yes, 110V, 50Hz
19	Whether separate remote control panel required		Yes
20	DC supply: - Nominal - Maximum float voltage	V V	110 125
21	Whether provision for supervisory control required, including AVR setting		Yes
22	Whether marshalling kiosk required		Tank side Cubicle
23	Number of transformers for which automatic control is to be suitable		3 (and provision for future one)
24	TERMINATIONS Bushing insulators or cable boxes on line and neutral terminals: i) HV line ii) Neutral iii) LV line iv) Tertiary winding		Oil/Air Bushings Oil/Air Bushings Oil/Air Bushings Oil/Air Bushings
25	BCT PARTICULARS i) HV (230 kV) Side		800/1A, 30VA,

	Core 1: Core 2: Core 3: ii) LV (132 kV) Side Core 1: Core 2: Core 3: Core 4: iii) Tertiary Side Core 1, 2 &3: iv) Neutral Side Core 1: Core 2: Core 3: Core 4:	5P20 (Core 1) for 87T2. 800/1A, 30VA, 5P20 (Core 2) for 67/67N 800/1A, 30VA, Class 0.2 (Core 3) for WT. 1600/1A 30VA 5P20 (Core 1) for 87T1 1600/1A 30VA 5P20 (Core 2) for REF. 1600/1A 30VA 5P20 (Core3) for 90 1600/1A, 30VA, Class 0.2 For WTI (Core 4) n/a CT 1 Cores 1600/1 5P20 30VA for REF
26	Pollution category of bushing insulators (Phase to Phase)	25 mm/kV of system rated (highest) voltage
27	COOLING i) Number of cooler banks required per transformer ii) Rating of each cooler bank as percentage of total loss at CMR iii) Standby cooling requirement	% To suit transformer design 50 One fan in each group
28	GENERAL Type of oil preservation system	Air Cell
29	Maximum acceptable noise level	78 dBA

APPENDIX A3

SCHEDULE OF TECHNICAL REQUIREMENTS OF 132kV XLPE POWER CABLES

4.1 132kV XLPE POWER CABLES

SL. Nos.	Description	
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1.	Rated system voltage	132 kV
2.	Max. permissible system voltage	145 kV
3.	Rated frequency	50 Hz
4.	Nos. of cable	1/phase
5.	Cross sectional area	subject to Short circuit rating for 3 sec and current-carrying capacity of 300MVA, conductor material Cu
6.	Impulse withstand voltage	650 kV
7.	Power frequency withstand voltage (1min)	275 kV
8.	Shape of conductor	Compact round
9.	Insulation thickness	minimum 15 mm
10.	Min. bending radius	15 D (D is external diameter of cable)
11.	DC resistance at 20°C	To be proposed
12.	Short circuit rating for 3 sec.	50 kA

APPENDIX A4

SCHEDULE OF TECHNICAL REQUIREMENTS OF NI-CAD BATTERY

SL. Nos. Description

1.	Installation	: Indoor
2.	Cell type	: Ni-cd
3.	Voltage (Normal)	: 1.2 volts per cell
4.	Float voltage	: 1.40-1.42 volt/cell
5.	Equalizing voltage	: 1.55 - 1.65 volt/cell
6.	Capacity in AH at 20°C	: 150 AH @ 5 Hr (for 110 V DC)
7.	Ambient temperature	: 45°C
8.	Positive plate	: Tubular
9.	Negative plate	: Pasted
10.	Type of container	: Plastic polymer
11.	Discharge voltage	: 1.0 V/Cell (This voltage shall be calculated and confirmed during execution by the contractor)
12.	Sp. gravity of electrolyte	: $1.19 \pm 1\%$
13.	Sp. gravity of electrolyte (Charged)	: $1.23 \pm .010$ at 20°C
14.	Vent plug	: Anti-corrosive & fire proof
15.	Cell condition	: Pre-charged.
16.	Battery stand	: Steel frame of step type
17.	Standard	: IEC or equivalent

APPENDIX A5

SCHEDULE OF TECHNICAL REQUIREMENTS OF 110 V BATTERY CHARGER

SL. Nos.	Description	
A) GENERAL		
1.	Installation	: Indoor
2.	Rectifier type	: Thyristor controlled.
3.	Rated D.C. voltage	: 110V $\pm 5\%$
4.	Rated output current	: 50Amps
5.	Charging mode	: Both constant current & constant voltage
6.	High Voltage Insulation	: 1000 V AC for 1 minute between input to output and input to ground
7.	Insulation resistance	: 10 M Ω with 500 V DC for 1 minute
8.	Cooling system	: Self & natural air cooled.
9.	Relative humidity	: Up to 98%
10.	Ambient temperature	: 45°C (max.)
11.	Noise level	: 65 dB (max)
12.	Altitude	: 1000 m
13.	Applicable Standard	: IEC or equivalent.

B) TECHNICAL DATA

A.C. INPUT

1.	Voltage	: 415 Volts
2.	Phase	: 3 Phase
3.	Frequency	: 50 $\pm 5\%$ Hz
4.	Input AC voltage variation	: $\pm 5\%$
5.	Power factor (Full range)	: 0.8
6.	Efficiency (Full load)	: 85%
7.	Charge Characteristics	: Constant current / Constant voltage (During float charge)
8.	Current limitation	: 110%

D.C. OUTPUT

1.	Voltage	: 110 $\pm 5\%$ volt
2.	Ripple Voltage (Full load)	: $\pm 3\%$
3.	Charge modes (3 level)	: Charge, Float charge & Boost charge
4.	Float Voltage (adjustable)	: 1.42 volt/cell
5.	Boost Voltage (adjustable)	: 1.53 volt/cell

APPENDIX A6

SCHEDULE OF TECHNICAL REQUIREMENTS OF SUBSTATION AUTOMATION SYSTEM

1. General Requirement:		
	Standards to be complied with Substation Automation system	
	Test Cab: Damp heat, steady state	IEC 60068-2-78
	Test Db: Damp heat, cycle (12h + 12h cycle)	IEC 60068-2-30
	Digital I/O, Analogue I/O dielectric Tests	IEC 60255-27
	Digital I/O, Surge withstand test	IEC 61000-4-5
	Radio interference test	IEC 60870-3/Class 2
	Transient fast burst test	IEC 61000-4-4
	Static Discharge	IEC 61000-4-2
	Electromagnetic fields	IEC 61000-4-3
	Temperature range (min/max)	°C 0/50
	Relative humidity	% 93
	Intelligent Electronic Devices (IED's)	
	- serial communication interface included?	Yes
	- Protection & Control IED's connected same bus?	Yes
	- self monitoring	Yes
	- display of measured values	Yes
	- remote parameterization	Yes
	- disturbance record upload and analysis	Yes
	Availability Calculation shall be furnished for each equipments as well as for the entire system	Yes
	The main part of the system, HMI, Gateway, shall be furnished with dual communication port against any failure.	Yes
	SNTP server shall provide GPS time-sync information to all communication (HMI, Gateway, IED) and the system shall be synchronized.	Yes
	Ethernet switch shall have dual system topology not to lose entire system with single switching system failure.	Yes
2. Detailed Requirements:		
	Number of years of proven field experience of offered system.	5 Yrs.
	(Note: proof of experience should be furnished. The components used in the offered system and those with field experience should be the same)	
	Design life of substation Automation System	15 Yrs
	Manufacturers quality assurance system	ISO 9001/9002 or equivalent
	Dimensions of cubicle	

	- Width - Depth - Height - Floor load	mm mm mm N/m2 max.6000
3. Station Level Equipment:		
	Station Controller MTBF (Mean time between Failures)	Industrial PC 50000Hrs
	Station computer shall have dual connection to Ether net switch as redundant (hot, standby) Hot standby take over time Dual Wide Monitor each HMI (over 25") Single wide screen Number of years of proven field experience of offered software	Yes Seconds Yes Yes 5 Yrs.
	Operating System All standard picture as per spec included in HMI Process Status Display & Command Procedures Event processing as per spec Alarm processing as per spec Reports as per spec Trend Display as per spec Graphical fault information receiving function Disturbance & Fault recording and analysis with graphical format User Authority levels as per spec System supervision & monitoring as per spec Automatic sequence control as per spec	Windows Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
4. Gateway to National Load dispatch Centre		
	Number of years of proven field experience of offered unit Insulation tests Fast disturbance tests Industrial environment Industrial grade hardware with no moving parts (PC based gateway is not accepted) Design life of offered equipment Redundant communication channel Redundant CPU Redundant DC/DC Supply MTBF (Mean time between Failures) Gateway shall have dual connection to ethernet switch (hot and standby)	5Yrs IEC 60255-27 IEC 61000-4-4, Class 4 EN 61000-6-4 Yes 15 Yrs Yes Yes Yes 50000Hrs Yes

5. Station Bus:		
	Physical Medium Each communication devices shall have dual connection, hot and standby.	Glass fibre optic Yes
6. Interbay Bus		
	Physical Medium	Glass fibre optic
7. Printer server		
	MTBF	200000Hrs
8. Hard Copy colour Printer		
	MTBF	180000Hrs
9. Master Clock – GPS (Global Positioning System) Receiver:		
	MTBF	150000Hrs
10. Bay control Unit - HV		
	Number of years of proven field experience of offered unit	5 Yrs.
	Separate Bay controller unit provided for each bay & feeder	Yes
	Type of bay controller offered HV/MV	HV
	Select Before Operate with Open Execute & Close Execute	Yes
	Single bit dependence	No
	Interlocking, bay & Station wide	Yes
	Synchrocheck function	
	- Maximum Voltage difference	Specify range
	- Maximum Frequency difference	Specify range
	- Maximum Phase difference	Specify range
	Double command blocking	Yes
	Independent settable parameter groups	4
	Local Display Unit	Yes
	Sequence of event recorder	
	- Events	256
	- Time resolution	1 ms
	Disturbance recording file transfer function	Yes
	Comtrade file generation function of Disturbance Recorder	Yes
	IED shall have dual connection to Ethernet switch (hot & standby)	Yes
	Comprehensive self-supervision	Yes
	Battery free backup of events and disturbance records	Yes
	Insulation tests	IEC 60255-27
	Fast disturbance tests	IEC 61000-4-4, Class 4
	MTBF	
	Temperature range: IED's	

	- Operation - Transport and storage	°C -10 to +50 °C -10 to +50
	Relative humidity: - Operating max./min - Transport and storage	% 93 % 93
11. Back up control mimic –HV		
	Control functionality: Control of breaker as well as all isolators/earthing switch (Control functionality should not be affected if bay controller fails) Key-Locked Interlock override function Separate backup control mimic provided for each bay & feeder	Yes Yes Yes Yes
12. Bay Control Unit – MV		
	Number of years of proven field experience of offered unit Separate Bay controller unit provided for each bay & feeder Type of bay controller offered HV/MV Select Before Operate with Open Execute & Close Execute Single bit dependence Interlocking, bay & Station wide Synchrocheck function - Maximum Voltage difference - Maximum Frequency difference - Maximum Phase difference Double command blocking Independent settable parameter groups Local Display Unit Sequence of event recorder - Events - Time resolution Disturbance recording file transfer function Comtrade file generation function of Disturbance Recorder IED have dual connection (hot & standby) Comprehensive self-supervision Battery free backup of events and disturbance records Insulation tests Fast disturbance tests	5Yrs Yes HV Yes No Yes Specify range Specify range Specify range Yes 4 Yes 256 1 ms Yes Yes Yes Yes IEC 60255-27 IEC 61000-4-4, Class 4

	MTBF Temperature range: IED's - Operation - Transport and storage Relative humidity: - Operating max./min - Transport and storage	°C -10 to +50 °C -10 to +50 % 93 % 93
	Exchange of display (First reaction) Presentation of a binary change in the process display Presentation of an analogue change in the process display From order to process output From order to updated of display	< 1 S < 0.5 S < 1 S < 0.5 S < 1.5 S

APPENDIX A7

SCHEDULE OF TECHNICAL REQUIREMENTS OF FIBRE OPTIC MULTIPLEXER EQUIPMENT

SL.Nos.	DESCRIPTION	UNIT	REQUIRED
1.0	GENERAL:		
1.1	Type of multiplexer		SDH: ADM
1.2	Complying to ITU-T rec.		Yes
1.3	Transmission Capacity	Mbit/s	STM-1: 155
1.4	Access capacity on 64 kbit/s	channels	Minimum 200
1.5	Access capacity on 2 Mbit/s	channels	Minimum 40
1.6	Redundant central processor		Shall be available
1.7	Digital cross connect function		Fully non-blocking
2.0	Available AGGREGATES:		
2.1	Optical aggregates (ITU-T G.957)		L-1.1, L-1.2
3.0	Available TRUNK INTERFACES:		
3.1	HDB3, 2 Mbit/s interfaces per module	Nos.	Minimum 8
3.2	Complying to ITU-T rec.		G.703, transparent G.704, selectable
3.3	HDSL, 2Mbit/s interface: no of copper wires Capacity on 2Mbit/s or on 1Mbit/s Capacity selectable	Nos. ch ch / pair of wire	4 or 2 30 or 15 30 / 2 pairs 30 / 1 pair 15 / 1 pair
4.0	Available USER INTERFACES		
4.1	Voice interfaces for trunk lines:		
4.1.1	1 + 1 com path protection, available for all		yes
4.1.2	Analogue, 4wire with E&M: Input level Output level	dBr	+7.5 .. -16 +7.0 .. -16.5
4.1.3	Analogue, 2wire with E&M: Input level Output level	dBr	+6.5 .. -12.5 -1.0 .. -20
4.1.4	Digital, 2Mbit/s CAS or PRI		Yes
4.2	Voice interfaces for remote subscriber:		
4.2.1	2wire, subscriber side	dBr	-5 .. +4 / -7.5 .. -1
4.2.2	2wire, PABX side	dBr	-5 .. +4 / -7.5 .. -3
4.3	Integrated teleprotection		
4.3.1	Interface for Commands:		
4.3.1.1	Number of independent commands	Nos.	4
4.3.1.2	Transmission time max.	ms	6
4.3.1.3	Signal voltage	V _{peak}	250
4.3.1.4	1 + 1 com path protection		yes
4.3.2	Interface(s) for Differential Protection:		
4.3.2.1	Electrical interface: G.703	kbit/s	64
4.3.2.2	Optical Interface	kbit/s	Minimum 64
4.4	Data: channels per module		
4.4.1	1 + 1 com path protection, available for all		yes

4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	Nos.	4
4.4.3	V.11/X.24 (RS-422): 64kbit/s	Nos.	4
4.4.4	V.35: 64kbit/s	Nos.	4
4.4.5	V.36 (RS-449): 64kbit/s	Nos.	2
4.4.6	G.703: 64kbit/s	Nos.	8
4.4.7	Ethernet: 10/100 BaseT WAN capacity Protocols	Nos. Mbit/s	1 Min: 2x 2Mbit/s Min.: IP
4.5	Integrated alarm gathering module:		
4.5.1	Number of external alarms per module	Nos.	Min. 20
4.5.2	Auxiliary power supply for ext. contacts		Yes
4.6	Network Management System		
4.6.1	Type/Name of configuration tool		
4.6.2	For fault / configuration management		Yes / yes
4.6.3	For local / remote operation		Yes / yes
4.6.4	Data communication network (DCN)		Ethernet / IP or Ethernet / OSI
4.7	Ambient Conditions:		
4.7.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-25 .. + 55 / class 1.2
4.7.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-25 .. + 70 / class 2.2
4.7.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 .. +45 / class 3.1E
4.8	Power Supply		
4.8.1	Operation	VDC	48 / 60 (-15/+20%)
4.8.2	Fully redundant power supply		yes

APPENDIX A8

SCHEDULE OF TECHNICAL REQUIREMENTS OF INSULATOR

1	Rated Voltage		230kV	132kV
2	Lightning impulse withstand positive and negative (kVp) (Dry and wet)		1050	650
3	Switching impulse withstand voltage (kVp)		-	-
4	One min. power freq. withstand voltage (kVrms) (Wet and Dry)		460	275
5	Total creepage distance (mm) pedestal		6125	3625
6	Total min. cantilever strength (kg)		800	800
7	Corona extinction voltage (kVrms)		156	n/a
8	Total min. height of insulator (mm)		2500	1500

APPENDIX A9

SCHEDULE OF TECHNICAL REQUIREMENTS OF INSULATOR STRING

1	Rated voltage		230kV
2	Type		Anti FOG
3	Size of insulators units (mm)		255 x 145
4	Creepage distance of individual insulator unit (Minimum or as required to obtain total creepage distance, mm)		430
5	Electromechanical strength (kN)		120
6	Power frequency withstand voltage of the complete string (kVrms)		460
7	Lightning impulse withstand voltage of the complete string with C.C. ring (Dry and wet, kVp)		1050
8	Switching surge withstand voltage of the complete string with C.C. rings(Dry & wet, kVp)		-
9	Power frequency puncture withstand voltage for a string insulator unit		1.3 times the actual wet flashover voltage of the unit.
10	Minimum corona extinction voltage level of the complete string with C.C. ring (Dry, kVrms)		156
11	R.I.V. Level of the complete string with C.C. ring. (micro V)		1000
12	Total creepage distance of complete insulator string (mm)		6125

APPENDIX A10

SCHEDULE OF TECHNICAL REQUIREMENTS OF DIGITAL FAULT AND DISTURBANCE RECORDER [DFDR] FOR 230/132KV SUBSTATION

Sl.	ITEM	UNITS	
(A)	GENERAL		
1.	Manufacturer's name & address		
2.	Type		
3.	Power Supply	VDC	110
	-Power supply for printer	VAC	240
(B)	ANALOGUE INPUTS		
1.	Number of Channel		136 for 230kV and
	-Expandability		Min. 120
2.	Nominal Current	Amp	1A/5A
3.	Nominal voltage	Vac/Vdc	
	- Current	mA/Amp	
4.	Frequency response		
5.	Cut-off frequency		
	(a) Bandwidth	dB	
	(b) Attenuation at	dB	
	(c) Auto adjusted anti-aliasing filters	Yes/No	Yes
	for chosen sampling rate		
	(d) Simultaneously programmable		Min 2 for FAST and SLOW Recording
	sampling rate for all feeders/inputs		Yes
	-Locally Changeable	Yes/No	Yes
	-Remotely Changeable	Yes/No	
	(e) Possible sampling rates		3 different sampling rates:
		Samples/sec	Slow. 1Hz-500Hz
		Samples/sec	fast: 0.5 kHz – 6kHz
		Samples/sec	continuous (variable rate)
6.	DC coupled inputs	Yes/No	Yes
7.	Resolution	bits	12 or better
8.	Accuracy	%	Min 0.5
9.	Burden		
	1. Current Circuit at IN	VA	
	2. Voltage Circuit	VA	
10.	Over load		
	1. Current	% In	100% In continuously, Min 600 % in
	2. Voltage circuit	% Vn	for 1 Second
			2Vn and max. 350 Vn
(C)	DIGITAL INPUTS		
1.	Number of Channel		360for 230kV
	-Expandability (Without and time		

2.	skew) Selectable input level	Vdc	N/O or N/C, 220 VDC
3.	Type		Potential or potential free contact
4.	Resolution	ms	
(D) MEMORY			
1.	Size	MB	64 MB or Higher
2.	Type		Solid State
3.	Pre-fault time (fast scanning rate)	sec	0.1-2 user programmable
4.	Post-fault (fast scanning rate)	sec	0.1-2 user programmable
5.	Pre and Post-fault time (slow scanning rate)	sec	min. 180 user programmable
6.	In-Built hard disk (auto-maintained)	GB	min. 4 GB
(E) SENSORS/ TRIGERRING CRITERIA			
	All sensors/trigerrrs are preferable Programmable and Virtually recordable	Yes/No	Yes
1.	Logical combination sensor	Yes/No	Yes
2.	Three phase over or under Voltage / Current	Yes/No	Yes
3.	Mono phase over or under Voltage / Current	Yes/No	Yes
4.	*du/dt, dp/dt, dq/dt, [Single/3 Phases], df/dt. etc.	Yes/No	Yes
5.	RMS [Voltage / Current]	Yes/No	Yes
6.	Zero Sequence	Yes/No	Yes
7.	Negative, Positive Sequence	Yes/No	Yes
8.	Frequency	Yes/No	Yes
9.	DC Step	Yes/No	Yes
10.	Pendling / Swing	Yes/No	Yes
11.	Digital level and edge	Yes/No	Yes
12.	Sensor trigger	Yes/No	Yes
13.	Event Trigger	Yes/No	Yes
14.	Manual Trigger	Yes/No	Yes
15.	Remote Trigger	Yes/No	Yes
(F) CLOCK SYSTEM			
1.	Internal Clock	Yes/No	Yes
2.	Accuracy		
3.	External Synchronization	Yes/No	Yes
4.	Time resolution between 2 synchronized pulses		
(G) OUTPUT ALARM RELAY			

	CONTACT		
1.	Max. operation Voltage DC/AC	Vac / Vdc	250 Vac or above, 60 Vdc or above
2.	Make and carry for 0.5 sec	A	Min 8A
3.	Carry Continuously	A	Min 5A
4.	Break (DC) – resistive	W	
(H)	INTERFACE FOR DATA COMMUNICATION		
1.	Full definition compression	Yes/No	Yes
2.	Maximum transmission rate	bits / Sec	
3.	Standard serial port (EIA-232-D)	Yes / No	Yes
4.	Printer Port	Yes/No	Yes
5.	Dedicated serial port for modem	Yes/No	Yes
(I)	PRINTER DATA		
1.	Printer amplitude (scaling peak to peak)		
2.	Time Scal (mm / s)		
3.	Printer resolution	mm	
4.	Auto printing	Yes/No	Yes
(J)	Fault Priority transmission	Yes/No	Yes
(K)	Fault location (distance calculation)	Yes/No	Yes
(L)	Test certificates from internationally recognized Laboratories	Yes/No	Yes
(M)	COMMUNICATION AND REMOTE ANALYZING UNIT		
	1. Processor Pentium	(MHz) Yes/No	Yes, at least 450 MHz Pentium
	2. Co-Processor Pentium	Yes/No	Yes
	3. Main memory capacity	(Mb) Yes/No	Yes, at least 64 MB
	4. Color graphics board S-VGA	Yes/No	Yes
	5. Screen S-VGA	Yes/No	Yes
	6. Hard disk unit	Yes/No	Yes, at least 40 GB
	7. Printer	Yes/No	Yes
	8. Modem	Yes/No	Yes.

*Note: du/dt=Change of voltage, dp/dt=Change of active power, dq/dt=change of reactive power, df/dt=Change of frequency.

APPENDIX A11

SCHEDULE OF TECHNICAL REQUIREMENTS OF CCTV FOR 230/132kV SUBSTATION

15.1 CCTV

Sl No	ITEM	SPECIFICATION
1.	Screen in Control room	-Two Screens -Split Screen -Automatic switching screen among cameras
2.	Colour monitor	Two
3.	100% duty cycle video surveillance system (not domestic type)	Yes
4.	Pre-programmed sequence	Yes
5.	Select/deselect and control any camera	Yes
6.	Control pan/tilt/zoom/focus function	Yes
7.	Image Sensor (Camera)	1/3" CCD
8.	Line Horizontal resolution(Camera)	480
9.	S/N Ratio of video signal (Camera)	More than 50db
10.	Electric light control (Camera)	From 0.1 to 20ms
11.	Video output signal (camera)	IV p-p PAL-B
12.	Back Light Compensation (camera)	Yes
13.	Tilt range	Over +10° to -90°
14.	Tilt speed	Not less than 10° per second
15.	Pan range	Over 340°
16.	Panning speed	Not less than 45° per second
17.	Zoom operation speed & focus operation (lenses)	Not exceed the magnetic ratio divided by 2
18.	IP Rating of Camera Housing, pan, tilt assembly	IP 65

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF PACKAGE SS-3 UPGRADATION OF THE EXISTING 132kV MADUNAGHAT SUBSTATION TO 230kV ON TURNKEY BASIS

SCHEDULE B

Schedules of Prices are given in the next pages. Bidders are requested to go through the relevant ITB Clauses carefully, mentioned in the Section -1 of Volume 2 of 3 and SCHEDULE A of Volume 3 of 3, to fill in the Price Schedules.

Price Schedules

Notes on Prices Schedules

General

1. The Price Schedules are divided into separate Schedules as follows:
Schedule No. 1: Plant (including Mandatory Spare Parts) Supplied from Abroad
Schedule No. 2: Plant (including Mandatory Spare Parts) Supplied from Within the Employer's Country
Schedule No. 3: Design Services
Schedule No. 4: Installation and Other Services
Schedule No. 5: Provisional Sums
Schedule No. 6: Grand Summary
Schedule No. 7: Recommended Spare Parts (Spare Parts for Operation and Maintenance)
2. The Schedules do not generally give a full description of the Plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their Bid.

Pricing

4. Prices shall be filled in indelible ink, and any alternations necessary due to errors, etc., shall be initialed by the Bidder.

As specified in the Bid Data Sheet and Particular Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.
5. Bid Prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Documents.

For each item, Bidders shall complete each appropriate column in the respective Schedules, giving the prices breakdown as indicated in the Schedules.

Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section VI (Employer's Requirements) or elsewhere in the Bidding Documents.

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
7. When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Schedules of Rates and Prices

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1B	230kV GIS Switchyard								
	230kV Outdoor Type Gas Insulated Switchgear (GIS)								
1B.1	230kV GIS Double Busbar, Line Feeder Bay with Local Control Cubicle and support structure		2	bays					
i	230kV, 4000A Gas Insulated Line (GIL) for double circuit overhead line connection with gas-to-air bushing including support structures		1	lot					
1B.2	230kV GIS Double Busbar, Auto Transformer Bay with Local Control Cubicle and support structure		3	bays					
1B.3	230kV GIS Double Busbar, Bus Coupler Bay with Local Control Cubicle and support structure		1	bay					
1B.4	230kV GIS Double Busbar, Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		1	bay					
	245kV Air Insulated Switchgear (AIS)								
1B.5	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz, Heavy duty class, metal oxide type, single phase surge arresters with surge counter and support structure		15	nos.					
1B.6	230kV post insulators to be installed between auto transformers and 230kV GIS transformer bays air terminations.		18	nos.					
1B.7	Rigid tubular bus and/or stranded conductors including all accessories for each connections for completing 230kV GIS Switchyard		1	lot					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1B.8	Insulators and fittings including all necessary clamps and connectors as required for completing 230kV GIS Switchyard		1	lot					
1B.9	Steel gantry for two (2) circuits of 230kV Transmission Line including all necessary accessories as required for completing 230kV GIS Switchyard		1	lot					
1B.10	Steel gantry for overhead circuits between Auto Transformers and 245kV GIS including overhead lines and all necessary accessories as required for completing 230kV GIS Switchyard		1	lot					
	Sub-total 1B								
1C	132kV Autotransformer to 132kV GIS Connections								
1C.1	Surge arrester 120kV rated voltage, , 10kA discharge current, gapless metal oxide type, single phase		9	set					
1C.2	132kV XLPE Power cable		1600	m					
1C.3	132kV outdoor cable termination		9	set					
1C.4	132kV GIS cable termination		9	set					
1C.5	rigid tubular bus and/or stranded conductors including accessories for of connection of 132kV cables to autotransformers and surge arresters		1	lot					
1C.6	Steel structures for equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV circuits		1	lot					
	Sub-total 1C								

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1E	Power Transformers								
1E.1	Deleted								
1E.2	230/132/33 kV, 235/300 MVA (ONAN/ONAF), three phase outdoor type auto transformer		3	nos.					
1E.3	Nitrogen injection Fire protection system for three (3) 230/138/33KV Auto transformers		1	lot					
	Sub-total 1E								
1F	Control, Protection, Substation Automation and Metering								
	230kV Circuits								
1F.1	Control, Monitoring, Protection & Substation Automation System for two (2) sets of 230kV overhead line circuits		1	lot					
1F.2	Control, Monitoring, Protection & Substation Automation System for three (3) sets of 230kV auto transformer circuits		1	lot					
1F.3	Control, Monitoring, Protection & Substation Automation System for one (1) sets of 245kV bus coupler bays		1	lot					
1F.4	Control, Monitoring, Protection & Substation Automation System for one (1) lot of 245kV busbars		1	lot					
1F.5	Tariff metering for 230kV system		1	lot					
1F.6	Digital Fault and Disturbance recorder (DFDR)		1	set					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
	Sub-total 1F								
1G	Multicore Cables								
1G.1	Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits		1	lot					
	Sub-total 1G								
1H	Earthing and Lightning Protection								
1H.1	Earthing and Lightning Protection		1	lot					
1H.2	Portable(maintenance) earthing equipment device		2	sets					
	Sub-total 1H								
1I	Batteries, chargers & DC distribution								
1I.1	110V Ni-cad Batteries with chargers and distribution boards								
i	110V Ni-cad Batteries, 150Ah @ 5h		1	set					
ii	Battery charger 110V, 50A		1	set					
iii	DC Distribution Board		1	set					
	Sub-total 1I								
1J	LVAC Distribution								
1J.1	LVAC switchboard for substation services		1	lot					
	Sub-total 1J								

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1K	Civil Works, Building and Foundation								
1K.1	Identification and relocation control and protection cables for existing 33kV feeders		1	lot					
1K.2	Dismantling and removal of the existing 132kV substation equipment		1	lot					
1K.3	Complete outdoor civil works excluding SPR Building								
i	Outdoor gantry foundation 230kV switchyard		1	lot					
ii	Outdoor equipment foundation 230kV switchyard		1	lot					
iii	Transformer foundation including oilpit & carriage way		1	lot					
iv	Blast wall		1	lot					
v	Internal road 6m wide		200	m					
vi	Surface draining		1	lot					
vii	Cable trench		1	lot					
viii	Switchyard surface finishing, drainage system including surface drain		1	lot					
ix	Gravel laying		1	lot					
x	Septic tank, soakaway		1	lot					
1K.4	SPR Building								
i	Foundation works		1	lot					
ii	Super structures		1	lot					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
iii	All finish works		1	lot					
1K.5	Fire alarm & fire fighting system		1	lot					
	Sub-total 1K								
1L	Lighting, small power, air conditioning and Ventilation								
1L.1	Lighting, small power, air conditioning and Ventilation and emergency DC lighting for SPR Building		1	lot					
1L.2	Lighting for outside buildings for security, roadway, switchyard and emergency DC lighting including steel poles (H=6m)		1	lot					
	Sub-total 1L								
1M	Fiber Optic Multiplexer Equipment for Communication and Protection								
1M.1	Extension of existing Fibre Optic Multiplexer Equipment		1	lot					
1M.2	Extension of existing PABX with subscriber telephone sets		1	lot					
1M.3	Fibre Optic cable and termination box		1	lot					
	Sub-total 1M								
1N	SCADA system for Telecontrol and Telemetry								
1N.1	Complete SCADA hardware & software		1	lot					
	Sub-total 1N								
2	Mandatory Spares								
2.1	245kV Gas Insulated Switchgear								

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
2.1.1	245kV Circuit Breaker								
2.1.1.1	Operating mechanism for circuit breaker		2	nos.					
2.1.1.2	Each type of closing coils and opening coils		15	nos.					
2.1.1.3	Each type of auxiliary contacts unit		3	nos.					
2.1.2	245kV Disconnectors and Earthing Switches								
2.1.2.1	Operating mechanism for disconnector		2	nos.					
2.1.2.2	Mechanical drive for high speed earthing switch		1	no.					
2.1.3	245kV Current Transformer								
2.1.3.1	Cores of each rating and each class		1	set					
2.1.4	245kV Voltage Transformer								
2.1.4.1	Winding of each rating and each class		1	set					
2.1.5	Special tools / instruments for operation and maintenance								
2.1.5.1	Special tools / instruments for operation and maintenance (To be listed up by Bidder)		1	set					
2.2.	245kV Outdoor equipment								
2.2.1	Complete set of 196kV Surge Arrester		1	set					
2.3.	145kV Outdoor equipment								
2.3.1	Complete set of 120kV Surge Arrester		1	set					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
2.3.2	132kV outdoor cable termination		1	set					
2.3.3	132kV GIS cable termination		1	set					
2.4	Protection and Control								
2.4.1	Each type of Protection relay and AVR		1	set					
2.4.2	Each type of Tripping relays		2	sets					
2.4.3	Each type of Auxiliary relays		5	sets					
2.4.4	Each type of Trip circuit supervision relays		1	set					
2.4.5	Each type of Bay Control Unit		1	set					
2.4.6	Each type of Switch (if applicable)		1	set					
2.4.7	Each type of MCB		1	set					
2.4.8	Each type of Lamps		10	sets					
2.4.9	Industrial PC		1	set					
2.4.10	Gateway Terminal		1	set					
2.4.11	Bay Ethernet Switches		2	nos.					
2.4.12	Optical connectors (one for each)		1	lot					
2.5	DC & Charger Equipment								
2.5.1	Each type of Printed Circuit Board		1	lot					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
2.5.2	Circuit breaker of each type and rating (Bidder to list all types)		1	lot					
2.6	LVAC Equipment								
2.6.1	Circuit breaker of each type and rating (Bidder to list all types)		1	lot					
2.7	Power, Control and Auxiliary Cables								
2.7.1	Power Cable (132kV)		300	m					
2.7.2	Control Cables, 200m of each type		1	lot					
2.7.3	LV cables, 200m of each type		1	lot					
2.7.4	Other cables (communication, etc.), 100m of each type		1	lot					
2.8	Transformers								
2.8.1	Auto Transformer								
2.8.1.1	Set of gaskets		1	no.					
2.8.1.2	Set of dial type thermometer with gaskets		1	no.					
2.8.1.3	Set of thermal image type indicator with gaskets		1	no.					
2.8.1.4	Set of Silica gel breather		1	no.					
2.8.1.5	Buchholz relay		1	no.					
2.8.1.6	Set of tap changer diverter switch		1	no.					
2.8.1.7	Tap changer control mechanism motor		1	no.					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
2.8.1.8	Transformer oil 200 litter barrel		10	nos.					
2.9	Instruments for Communication & SCADA								
2.9.1	Digital data (Communication) analyzer		1	lot					
2.9.2	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility		1	lot					
2.9.3	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)		1	lot					
2.9.4	Subscriber Module for DCS 255 Exchange		1	lot					
2.10	Post Type Insulator								
2.10.2	For 245kV		3	nos.					
2.11	Gas Insulated Line (GIL)								
2.11.1	245kV, 4000A, GIL		25	m					
2.12	Disc Insulator								
2.12.1	Each type of Disc Insulator		20	nos.					
2.13	Conductor								
2.13.1	Each type of Bus Conductor		25	m					
2.13.2	Each size of Rigid Tubular Conductor		10	m					

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

(In case of any item will be supplied from within the Employer's Country, please select these items and indicate their prices in the Schedule No.2.)

Item	Description	Code ¹	Qty. (1)	Unit	Currency	Unit Price ²		Total Price ²	
						CIP		CIP	
						Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
2.14	Clamp and Fitting								
2.14.1	Each type of Clamps and Fittings		6	nos.					
	Sub-total 2								
TOTAL OF SCHEDULE NO.1 (To be indicated in Schedule No.6 Grand Summary)					Foreign Currency (1)				
					Foreign Currency (2)				
					Foreign Currency (3)				
					Local Currency (Taka)				

¹ Bidders shall enter a code representing the country of origin of all imported plant and equipment.

² Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
						(2)	(3)	
			(1)					(1) x {(2) + (3)}
1B	230kV GIS Switchyard							
	230kV Outdoor Type Gas Insulated Switchgear (GIS)							
1B.1	230kV GIS Double Busbar, Line Feeder Bay with Local Control Cubicle and support structure		2	bays				
i	230kV, 4000A Gas Insulated Line (GIL) for double circuit overhead line connection with gas-to-air bushing including support structures		1	lot				
1B.2	230kV GIS Double Busbar , Auto Transformer Bay with Local Control Cubicle and support structure		3	bays				
1B.3	230kV GIS Double Busbar , Bus Coupler Bay with Local Control Cubicle and support structure		1	bay				
1B.4	230kV GIS Double Busbar , Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		1	bay				
	245kV Air Insulated Switchgear (AIS)							
1B.5	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz. Heavy duty class, metal oxide type, single		15	nos.				
1B.6	230kV post insulators to be installed between auto transformers and 230kV GIS transformer bays air terminations.		18	nos.				
1B.7	Rigid tubular bus and/or stranded conductors including all accessories for each connections for completing 230kV GIS		1	lot				
1B.8	Insulators and fittings including all necessary clamps and connectors as required for completing 230kV GIS Switchyard		1	lot				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
1B.9	Steel gantry for two (2) circuits of 230kV Transmission Line including all necessary accessories as required for completing 230kV GIS Switchyard		1	lot				
1B.10	Steel gantry for overhead circuits between Auto Transformers and 245kV GIS including overhead lines and all necessary accessories as required for completing 230kV GIS Switchyard		1	lot				
	Sub-total 1B							
1C	132kV Autotransformer to 132kV GIS Connections							
1C.1	Surge arrester 120kV rated voltage, , 10kA discharge current, gapless metal oxide type, single phase		9	set				
1C.2	132kV XLPE Power cable		1600	m				
1C.3	132kV outdoor cable termination		9	set				
1C.4	132kV GIS cable termination		9	set				
1C.5	rigid tubular bus and/or stranded conductors including accessories for of connection of 132kV cables to autotransformers and surge arresters		1	lot				
1C.6	Steel structures for equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV circuits		1	lot				
	Sub-total 1C							

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
1E	Power Transformers							
1E.1	Deleted							
1E.2	230/132/33 kV, 235/300 MVA (ONAN/ONAF), three phase outdoor type auto transformer		3	nos.				
1E.3	Nitrogen injection Fire protection system for three (3) 230/138/33KV Auto transformers		1	lot				
	Sub-total 1E							
1F	Control, Protection, Substation Automation and Metering							
	230kV Circuits							
1F.1	Control, Monitoring, Protection & Substation Automation System for two (2) sets of 230kV overhead line circuits		1	lot				
1F.2	Control, Monitoring, Protection & Substation Automation System for three (3) sets of 230kV auto transformer circuits		1	lot				
1F.3	Control, Monitoring, Protection & Substation Automation System for one (1) sets of 245kV bus coupler bays		1	lot				
1F.4	Control, Monitoring, Protection & Substation Automation System for one (1) lot of 245kV busbars		1	lot				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
1F.5	Tariff metering for 230kV system		1	lot				
1F.6	Digital Fault and Disturbance recorder (DFDR)		1	set				
	Sub-total 1F							
1G	Multicore Cables							
1G.1	Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits		1	lot				
	Sub-total 1G							
1H	Earthing and Lightning Protection							
1H.1	Earthing and Lightning Protection		1	lot				
1H.2	Portable(maintenance) earthing equipment device		2	sets				
	Sub-total 1H							
1I	Batteries, chargers & DC distribution							
1I.1	110V Ni-cad Batteries with chargers and distribution boards							

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
i	110V Ni-cad Batteries, 150Ah @ 5h		1	set				
ii	Battery charger 110V, 50A		1	set				
iii	DC Distribution Board		1	set				
	Sub-total 1I							
1J	LVAC Distribution							
1J.1	LVAC switchboard for substation services		1	lot				
	Sub-total 1J							
1K	Civil Works, Building and Foundation							
1K.1	Identification and relocation control and protection cables for existing 33kV feeders		1	lot				
1K.2	Dismantling and removal of the existing 132kV substation equipment		1	lot				
1K.3	Complete outdoor civil works excluding SPR Building							
i	Outdoor gantry foundation 230kV switchyard		1	lot				
ii	Outdoor equipment foundation 230kV switchyard		1	lot				
iii	Transformer foundation including oilpit & carriage way		1	lot				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
iv	Blast wall		1	lot				
v	Internal road 6m wide		200	m				
vi	Surface draining		1	lot				
vii	Cable trench		1	lot				
viii	Switchyard surface finishing, drainage system including surface drain		1	lot				
ix	Gravel laying		1	lot				
x	Septic tank, soakaway		1	lot				
1K.4	SPR Building							
i	Foundation works		1	lot				
ii	Super structures		1	lot				
iii	All finish works		1	lot				
1K.5	Fire alarm & fire fighting system		1	lot				
	Sub-total 1K							

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
1L	Lighting, small power, air conditioning and Ventilation							
1L.1	Lighting, small power, air conditioning and Ventilation and emergency DC lighting for SPR Building		1	lot				
1L.2	Lighting for outside buildings for security, roadway, switchyard and emergency DC lighting including steel poles (H=6m)		1	lot				
	Sub-total 1L							
1M	Fiber Optic Multiplexer Equipment for Communication and Protection							
1M.1	Extension of existing Fibre Optic Multiplexer Equipment		1	lot				
1M.2	Extension of existing PABX with subscriber telephone sets		1	lot				
1M.3	Fibre Optic cable and termination box		1	lot				
	Sub-total 1M							
1N	SCADA system for Telecontrol and Telemetry							
1N.1	Complete SCADA hardware & software		1	lot				
	Sub-total 1N							
2	Mandatory Spares							
2.1	245kV Gas Insulated Switchgear							
2.1.1	245kV Circuit Breaker							
2.1.1.1	Operating mechanism for circuit breaker		2	nos.				
2.1.1.2	Each type of closing coils and opening coils		15	nos.				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	
2.1.1.3	Each type of auxiliary contacts unit		3	nos.				
2.1.2	245kV Disconnectors and Earthing Switches							
2.1.2.1	Operating mechanism for disconnector		2	nos.				
2.1.2.2	Mechanical drive for high speed earthing switch		1	no.				
2.1.3	245kV Current Transformer							
2.1.3.1	Cores of each rating and each class		1	set				
2.1.4	245kV Voltage Transformer							
2.1.4.1	Winding of each rating and each class		1	set				
2.1.5	Special tools / instruments for operation and maintenance							
2.1.5.1	Special tools / instruments for operation and maintenance (To be listed up by Bidder)		1	set				
2.2.	245kV Outdoor equipment							
2.2.1	Complete set of 196kV Surge Arrester		1	set				
2.3.	145kV Outdoor equipment							
2.3.1	Complete set of 120kV Surge Arrester		1	set				
2.3.2	132kV outdoor cable termination		1	set				
2.3.3	132kV GIS cable termination		1	set				
2.4	Protection and Control							

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
						(2)	(3)	
			(1)					(1) x {(2) + (3)}
2.4.1	Each type of Protection relay and AVR		1	set				
2.4.2	Each type of Tripping relays		2	sets				
2.4.3	Each type of Auxiliary relays		5	sets				
2.4.4	Each type of Trip circuit supervision relays		1	set				
2.4.5	Each type of Bay Control Unit		1	set				
2.4.6	Each type of Switch (if applicable)		1	set				
2.4.7	Each type of MCB		1	set				
2.4.8	Each type of Lamps		10	sets				
2.4.9	Industrial PC		1	set				
2.4.10	Gateway Terminal		1	set				
2.4.11	Bay Ethernet Switches		2	nos.				
2.4.12	Optical connectors (one for each)		1	lot				
2.5	DC & Charger Equipment							
2.5.1	Each type of Printed Circuit Board		1	lot				
2.5.2	Circuit breaker of each type and rating (Bidder to list all types)		1	lot				
2.6	LVAC Equipment							

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
						(2)	(3)	
			(1)					(1) x {(2) + (3)}
2.6.1	Circuit breaker of each type and rating (Bidder to list all types)		1	lot				
2.7	Power, Control and Auxiliary Cables							
2.7.1	Power Cable (132kV)		300	m				
2.7.2	Control Cables, 200m of each type		1	lot				
2.7.3	LV cables, 200m of each type		1	lot				
2.7.4	Other cables (communication, etc.), 100m of each type		1	lot				
2.8	Transformers							
2.8.1	Auto Transformer							
2.8.1.1	Set of gaskets		1	no.				
2.8.1.2	Set of dial type thermometer with gaskets		1	no.				
2.8.1.3	Set of thermal image type indicator with gaskets		1	no.				
2.8.1.4	Set of Silica gel breather		1	no.				
2.8.1.5	Buchholz relay		1	no.				
2.8.1.6	Set of tap changer diverter switch		1	no.				
2.8.1.7	Tap changer control mechanism motor		1	no.				
2.8.1.8	Transformer oil 200 litter barrel		10	nos.				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty.	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
			(1)			(2)	(3)	(1) x {(2) + (3)}
2.9	Instruments for Communication & SCADA							
2.9.1	Digital data (Communication) analyzer		1	lot				
2.9.2	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35		1	lot				
2.9.3	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)		1	lot				
2.9.4	Subscriber Module for DCS 255 Exchange		1	lot				
2.10	Post Type Insulator							
2.10.2	For 245kV		3	nos.				
2.11	Gas Insulated Line (GIL)							
2.11.1	245kV, 4000A, GIL		25	m				
2.12	Disc Insulator							
2.12.1	Each type of Disc Insulator		20	nos.				
2.13	Conductor							
2.13.1	Each type of Bus Conductor		25	m				
2.13.2	Each size of Rigid Tubular Conductor		10	m				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

(In case of any item supplied from within the Employer's Country , please select the Items and indicate the prices)

Item	Description	Code	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹
						EXW Price	Local Transportation and insurance	
						(2)	(3)	(1) x {(2) + (3)}
2.14	Clamp and Fitting							
2.14.1	Each type of Clamps and Fittings		6	nos.				
	Sub-total 2							
TOTAL OF SCHEDULE NO.2 (To be indicated in Schedule No.6 Grand Summary)					Foreign Currency (1)			
					Foreign Currency (2)			
					Foreign Currency (3)			
					Local Currency (Taka)			
					Name of Bidder			
					Signature of Bidder			

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

² Cubic meter for land development and Length for security boundary wall & chain link fencing shall be finalized during execution stage and payment shall be based on actual one.

Country of Origin Declaration Form

SB-27

Schedule No. 3. Design Services

(Special Notes)

1) The Design Services, shall include Project managing/ engineering fees such as, Liaison, overall substation design, project schedule & control , drawings/ documentation handling, contract issues, cash flows, periodical reporting, Project progress meeting and etc., which are not including in equipment, installation, site testing and civil works for the Package SS-2 Contract.

2) The design fees for plant and mandatory spare parts shall be included in Schedule No .1 or 2.

3) The design fees for erection/Installation, commissioning and Civil works shall be including in related items of Schedule No.4.

Item	Description	Qty. <i>(1)</i>	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign Currency Portion <i>(2)</i>	Local Currency Portion <i>(3)</i>	Foreign <i>(1) x (2)</i>	Local <i>(1) x (3)</i>
3.1	Project Managing/Engineering Fees	1	lot					
TOTAL OF SCHEDULE NO.3 (To be indicated in Schedule No.6 Grand Summary)				Foreign Currency (1)				
				Foreign Currency (2)				
				Foreign Currency (3)				
				Local Currency (Taka)				
				Name of Bidder _____				
				Signature of Bidder _____				

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1B	230kV GIS Switchyard							
	230kV Outdoor Type Gas Insulated Switchgear (GIS)							
1B.1	230kV GIS Double Busbar, Line Feeder Bay with Local Control Cubicle and support structure	2	bays					
i	230kV, 4000A Gas Insulated Line (GIL) for double circuit overhead line connection with gas-to-air bushing including support structures	1	lot					
1B.2	230kV GIS Double Busbar, Auto Transformer Bay with Local Control Cubicle and support structure	3	bays					
1B.3	230kV GIS Double Busbar, Bus Coupler Bay with Local Control Cubicle and support structure	1	bay					
1B.4	230kV GIS Double Busbar, Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	1	bay					
	245kV Air Insulated Switchgear (AIS)							
1B.5	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz. Heavy duty class, metal oxide type, single phase	15	nos.					
1B.6	230kV post insulators to be installed between auto transformers and 230kV GIS transformer bays air terminations.	18	nos.					
1B.7	Rigid tubular bus and/or stranded conductors including all accessories for each connections for completing 230kV GIS Switchyard	1	lot					
1B.8	Insulators and fittings including all necessary clamps and connectors as required for completing 230kV GIS Switchyard	1	lot					

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1B.9	Steel gantry for two (2) circuits of 230kV Transmission Line including all necessary accessories as required for completing 230kV GIS Switchyard	1	lot					
1B.10	Steel gantry for overhead circuits between Auto Transformers and 245kV GIS including overhead lines and all necessary accessories as required for completing 230kV GIS Switchyard	1	lot					
	Sub-total 1B							
1C	132kV Autotransformer to 132kV GIS Connections							
1C.1	Surge arrester 120kV rated voltage, , 10kA discharge current, gapless metal oxide type, single phase	9	set					
1C.2	132kV XLPE Power cable	1600	m					
1C.3	132kV outdoor cable termination	9	set					
1C.4	132kV GIS cable termination	9	set					
1C.5	rigid tubular bus and/or stranded conductors including accessories for of connection of 132kV cables to autotransformers and surge arresters	1	lot					
1C.6	Steel structures for equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV circuits	1	lot					
	Sub-total 1C							

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1E	Power Transformers							
1E.1	Deleted							
1E.2	230/132/33 kV, 235/300 MVA (ONAN/ONAF), three phase outdoor type auto transformer	3	nos.					
1E.3	Nitrogen injection Fire protection system for three (3) 230/138/33KV Auto transformers	1	lot					
	Sub-total 1E							
1F	Control, Protection, Substation Automation and Metering							
	230kV Circuits							
1F.1	Control, Monitoring, Protection & Substation Automation System for two (2) sets of 230kV overhead line circuits	1	lot					
1F.2	Control, Monitoring, Protection & Substation Automation System for three (3) sets of 230kV auto transformer circuits	1	lot					
1F.3	Control, Monitoring, Protection & Substation Automation System for one (1) sets of 245kV bus coupler bays	1	lot					
1F.4	Control, Monitoring, Protection & Substation Automation System for one (1) lot of 245kV busbars	1	lot					

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1F.5	Tariff metering for 230kV system	1	lot					
1F.6	Digital Fault and Disturbance recorder (DFDR)	1	set					
	Sub-total 1F							
1G	Multicore Cables							
1G.1	Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits	1	lot					
	Sub-total 1G							
1H	Earthing and Lightning Protection							
1H.1	Earthing and Lightning Protection	1	lot					
1H.2	Portable(maintenance) earthing equipment device	2	sets					
	Sub-total 1H							
1I	Batteries, chargers & DC distribution							
1I.1	110V Ni-cad Batteries with chargers and distribution boards							

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
i	110V Ni-cad Batteries, 150Ah @ 5h	1	set					
ii	Battery charger 110V, 50A	1	set					
iii	DC Distribution Board	1	set					
	Sub-total II							
1J	LVAC Distribution							
1J.1	LVAC switchboard for substation services	1	lot					
	Sub-total 1J							
1K	Civil Works, Building and Foundation							
1K.1	Identification and relocation control and protection cables for existing 33kV feeders	1	lot					
1K.2	Dismantling and removal of the existing 132kV substation equipment	1	lot					
1K.3	Complete outdoor civil works excluding SPR Building							
i	Outdoor gantry foundation 230kV switchyard	1	lot					
ii	Outdoor equipment foundation 230kV switchyard	1	lot					
iii	Transformer foundation including oilpit & carriage way	1	lot					

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
iv	Blast wall	1	lot					
v	Internal road 6m wide	200	m					
vi	Surface draining	1	lot					
vii	Cable trench	1	lot					
viii	Switchyard surface finishing, drainage system including surface drain	1	lot					
ix	Gravel laying	1	lot					
x	Septic tank, soakaway	1	lot					
1K.4	SPR Building							
i	Foundation works	1	lot					
ii	Super structures	1	lot					
iii	All finish works	1	lot					
1K.5	Fire alarm & fire fighting system	1	lot					
	Sub-total 1K							

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
1L	Lighting, small power, air conditioning and Ventilation							
1L.1	Lighting, small power, air conditioning and Ventilation and emergency DC lighting for SPR Building	1	lot					
1L.2	Lighting for outside buildings for security, roadway, switchyard and emergency DC lighting including steel poles (H=6m)	1	lot					
	Sub-total 1L							
1M	Fiber Optic Multiplexer Equipment for Communication and Protection							
1M.1	Extension of existing Fibre Optic Multiplexer Equipment	1	lot					
1M.2	Extension of existing PABX with subscriber telephone sets	1	lot					
1M.3	Fibre Optic cable and termination box	1	lot					
	Sub-total 1M							
1N	SCADA system for Telecontrol and Telemetry							
1N.1	Complete SCADA hardware & software	1	lot					
	Sub-total 1N							

Schedule No. 4. Installation and Other Services

Schedule No. 4.1 Civil Works, Installation and Site tests / Commissioning of Equipment

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
TOTAL OF SCHEDULE NO. 4.1 (To be indicated in Schedule No.6 Grand Summary)				Foreign Currency (1)				
				Foreign Currency (2)				
				Foreign Currency (3)				
				Local Currency (Taka)				
				Name of Bidder _____				
				Signature of Bidder _____				

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

² Cubic meter for land development and Length for security boundary wall & chain link fencing shall be finalized during execution stage and payment shall be based on actual one.

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Schedule No. 4.2 –Other Services

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
4.2.1	International Training							
(a)	Control, protection & Substation Automation System (SAS) at Manufacturer's Works Two (2) Engineers, Two (2) weeks	1	lot					
(b)	SCADA telecommunication system including multiplexer and PABX at Manufacturer's Works Two (2) Engineers, Two (2) weeks	1	lot					
(c)	Design for HV GIS Substation at International Reputed Training Center Four (4) Engineers, Two (2) weeks	1	lot					
(d)	Operation and Maintenance for HV GIS Substation at International Reputed Training Center Eight (8) Engineers, Two (2) weeks	1	lot					
	Sub-total 4.2.1							
4.2.2	Witness of Factory Acceptance Tests of Equipment							
(a)	230/132/33kV, Three (3) Phase, 300MVA Auto Transformers Two (2) Engineers with one (1) Consultant, Ten (10) days	1	lot					
(d)	245kV GIS: Two (2) Engineers with one (1) Consultant, Ten (10) days	1	lot					
(g)	245kV and 145kV Lightning Arresters Two (2) Engineers, Seven (7) days	1	lot					

Schedule No. 4. Installation and Other Services

Schedule No. 4.2 –Other Services

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
(h)	Control, Protection & Substation Automation System (SAS) Two (2) Engineers with one (1) Consultant, Seven (7) days	1	lot					
	Sub-total 4.2.2							
4.2.3	O & M Training at Site							
(a)	Substation facilities including HV GIS & Transformers Fifteen (15) Engineers, 2 Weeks	1	lot					

Schedule No. 4. Installation and Other Services

Schedule No. 4.2 –Other Services

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
(b)	Protection and Substation Automation System (SAS) Fifteen (15) Engineers, 2 Weeks	1	lot					
(c)	Fibre Optic Multiplexer & digital PABX Fifteen (15) Engineers, 2 Weeks	1	lot					
	Sub-total 4.2.3							
4.2.4	Employer's Engineer's Office Accomodation at Site	1	lot					
(a)	Office accommodation with specified facilities and services during construction period	1	lot					
(b)	Security guard services for Engineer's Office at Site	1	lot					
	Sub-total 4.2.4							
TOTAL OF SCHEDULE NO.4.2 (To be indicated in Schedule No.6 Grand Summary)				Foreign Currency (1)				
				Foreign Currency (2)				
				Foreign Currency (3)				
				Local Currency (Taka)				
				Name of Bidder _____				
				Signature of Bidder _____				

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

Schedule of No.5.1 Provisional Sums of Security Module

Provisional sum of security module shall be as per Section 23 of Vol. 3 of Bidding Document, and the Bidder may insert more items in the below table but the total price shall not exceed the ceiling amount BDT 20,000,000. (This price as reference only is excluded from the price bid evaluation.)

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					<i>CIP</i>		<i>CIP</i>	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
5.1.1	Security Infrastructure							
5.1.1.1	Perimeter Security Fence							
5.1.1.1.1	Construction (Relocating Facility only)							
5.1.1.1.2	Maintenance (Overall Length of Road) (up to TOC)							
5.1.1.2	Watch Tower with Security Alarms and Searchlights (including the payment of electricity bill)							
5.1.1.2.1	Construction and Installation (Additional)							
5.1.1.2.2	Relocation							
5.1.1.2.3	Maintenance (Overall Length of Road) (up to TOC)							
5.1.1.3	Security Lighting along the Perimeter Fence							
5.1.1.3.1	Construction and Installation (Relocating Facility only)							
5.1.1.3.2	Maintenance (Overall Length of Road) (up to TOC)							
5.1.1.4	Security Barriers and Gates							
5.1.1.4.1	Construction and Installation							
5.1.1.4.2	Maintenance(up to TOC)							

Schedule of No.5.1 Provisional Sums of Security Module

Provisional sum of security module shall be as per Section 23 of Vol. 3 of Bidding Document, and the Bidder may insert more items in the below table but the total price shall not exceed the ceiling amount BDT 20,000,000. (This price as reference only is excluded from the price bid evaluation.)

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					CIP		CIP	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
5.1.1.5	Security Command and Control Centre (SCCC)							
5.1.1.5.1	SCCC Prefabricated Building with Utility Facilities							
5.1.1.5.2	Equipment Furniture and Furnishing							
5.1.1.5.3	Maintenance							
5.1.1.6	Redundant Power Supply for All Security Lighting, Watch Tower and Associated Equipment (inculding that provided by the Employer)							
5.1.1.6.1	Supply and Installation							
5.1.1.6.2	Maintenance							
5.1.1.6.3	Fuel							
5.1.1.7	Maintenance of helipad							
5.1.2	Security Equipment							
5.1.2.1	CCTV							
5.1.2.1.1	Supply and Installation of CCTV Cameras (To install two camera associate with W/T)							
5.1.2.1.2	Supply and Installation of CCTV Monitoring System							
5.1.2.1.3	Maintenance of CCTV Cameras and Monitoring System							

Schedule of No.5.1 Provisional Sums of Security Module

Provisional sum of security module shall be as per Section 23 of Vol. 3 of Bidding Document, and the Bidder may insert more items in the below table but the total price shall not exceed the ceiling amount BDT 20,000,000. (This price as reference only is excluded from the price bid evaluation.)

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					CIP		CIP	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
5.1.2.2	Security Alarm System							
5.1.2.2.1	Supply and Installation							
5.1.2.2.2	Maintenance							
5.1.2.3	Security Equipment							
5.1.2.3.1	Supply and Installation of Door Frame Metal Detector							
5.1.2.3.1	Maintenance of Door Frame Metal Detector							
5.1.2.3.3	Supply of Hand Held Metal Detector							
5.1.2.3.4	Maintenance of Hand Held Metal Detector							
5.1.2.3.5	Supply and Installation of PTZ Camera for main entry gates (including cabling)							
5.1.2.3.6	Maintenance of PTZ Camera							
5.1.2.3.7	Radio Sets							
5.1.2.4	Communication Equipment							
5.1.2.4.1	GPS Tracking, First-Aid-Kit and mobile Phone Communication fitted with vehicles and Boat							
5.1.2.4.2	Communication Charge							
5.1.2.5	Identification Bade / Card System							

Schedule of No.5.1 Provisional Sums of Security Module

Provisional sum of security module shall be as per Section 23 of Vol. 3 of Bidding Document, and the Bidder may insert more items in the below table but the total price shall not exceed the ceiling amount BDT 20,000,000. (This price as reference only is excluded from the price bid evaluation.)

Item	Description	Qty. (1)	Unit	Currency	Unit Price ¹		Total Price ¹	
					CIP		CIP	
					Foreign (2)	Local (Taka) (3)	Foreign (1) x (2)	Local (Taka) (1) x (3)
5.1.2.5.1	Supply and Maintenance							
5.1.2.6	Consultation with security agencies in periodical review							
5.1.2.7	Evacuation in case of Emergency							
5.1.3	Security Personnel for Additional Security Module							
5.1.3.1	Security Supervisors							
5.1.3.2	Security Guards							
TOTAL OF SCHEDULE NO. 5.1 (To be indicated in Schedule No.6 Grand Summary)				Foreign Currency (1)				
				Foreign Currency (2)				
				Foreign Currency (3)				
				Local Currency (Taka)				
				Name of Bidder				
				Signature of Bidder				

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

Schedule of No.6 Grand Summary

Item	Description		Foreign Currency	Total Price ¹	
				Foreign	Local (Taka)
6.1	Total Schedule No.1 (Plant and Equipment, Mandatory Spare Parts and Instrument supplied from Abroad)		Currency 1		
			Currency 2		
			Currency 3		
6.2	Total Schedule No.2 (Plant and Equipment, Mandatory Spare Parts and Instrument supplied from Within the Employer's Country)		Currency 1		
			Currency 2		
			Currency 3		
6.3	Total Schedule No.3 (Design Services)		Currency 1		
			Currency 2		
			Currency 3		
6.4		Sub-total Schedule No.4.1 (Civil Works, Installation, Site Tests and Commissioning of Plant)	Currency 1		
			Currency 2		
			Currency 3		
		Sub-total Schedule No.4.2 (Other Services)	Currency 1		
			Currency 2		
			Currency 3		
		Total (4.1 + 4.2)	Currency 1		
			Currency 2		
			Currency 3		
6.5	Total Schedule No.5 (Provisional Sums)	Sub-total Schedule No.5.1	Not Applicable		
		Sub-total Schedule No.5.2	Not Applicable		
6.6	GRAND TOTAL (Schedule No.1 to Schedule No.4 (to Letter of Price Bid))		Foreign Currency (1)		
			Foreign Currency (2)		
			Foreign Currency (3)		
			Local Currency (Taka)		
			Name of Bidder _____		
			Signature of Bidder _____		

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

Schedule No. 7. Recommended Spare Parts

Item	Description	Code ¹ (Country)	Qty. (1)	Unit	Currency	Unit Price ²			Total Price ²	
						FOB Price (2)	CIP Price		CIP Price	
							Foreign Currency	Local Currency	Foreign Currency	Local Currency
							(3)	(4)	(1) x (3)	(1) x (4)
	TOTAL SCHEDULE NO.7 Recommended Spare Parts					Currency 1				/
						Currency 2				
						Currency 3				
						Local Currency (Taka)				
					Name of Bidder _____ Signature of Bidder _____					

1 Bidder shall enter a code representing the country of origin of all imported plant and equipment.

2 Specify currency in accordance with specifications in Bid Data Sheet under ITB 19.1 in Single-Stage Bid. Create and use as many columns for Unit Price and Total Price as there are currencies.

Schedules of Rates and Prices

SCHEDULE No. 8 - DAY WORKS

1)

No works whatsoever may be executed as day works, nor will payment be made for any Day works except in accordance with provisions of the Conditions of Contract, and with prior written authorization of the Engineer/ Employer.
LABOUR

2)

The Contractor shall be entitled to the following payments in respect of labour employed on Day works:

The aggregate amount of wages for such labour calculated on the actual hours worked at the wage rate set out in this schedule up to the grade of charge hand or overseer working with the men.

3)

The wages given in this schedule shall cover Contractor's profit, on cost, superintendence, insurance and all allowances to labour, time keeping and all clerical and office work as well as the use of tools, timber, light equipment and non-mechanical equipment and all incidental charges whatever.

4)

The "Normal working Day" as hereinafter referred to shall be taken to be of eight hours excluding meal breakers and rest periods.

5)

Including the sums due to the Contractor for the execution of Day works, the hours for which payment shall be made for all personnel and the hire of all equipment shall be reckoned from the time of starting the particular item of day work, either at the beginning of or during the course of a normal working day to the end of the normal working day or the time of completion of the particular item of Day work, whichever maybe sooner. No payment shall be made for personnel or plant for hours outside the normal working day unless the said personnel and plant are employed on Day works outside the Normal Working Day on the written instruction of the Employer's Representative, The same Day work rate shall apply for works done both during and outside the Normal Working Day.

6)

On completion of any authorized Day works, a written statement shall be issued by the Employer's Representative who shall sign it together with the Contractor and which shall state the number of workmen and their grades involved in the Day work, the number of hours worked and a detailed description of the Material used and the work carried out. A copy of this signed statement shall be retained by the Employer's Representative and the Contractor and shall be the sole basis upon which payment for Day Works will be made.

7)

Day Work Rate for Labour

Class of Labour	Normal Working Day of 8 Hours Local Taka/Day
Local Labour	
Unskilled Labourer	
Skilled Labourer	
Driver	
Steel Erector	
Surveyor (on survey work only)	
Mason/ concrete work	
Carpenter	
Bar-bender/ Steel fixer	
Welder	
Welder's assistant	
Painter	
Crane operator	
Bulldozer/ grader operator	
Expatriate Labour	Normal Working Day of 8 Hours Foreign Currency - Per Day
Junior Engineer	
Senior Engineer	

- 8) Any other class of labour envisaged by Contractors for the execution of any Day works, except that covered by Paragraph 3 above, i.e. superintendent, etc., shall be entered above together with the appropriate labour rates, and such rates shall be the only rates considered in any Day works claim.
- 9) The labour rates to be entered above shall include all other benefits or contributions made by the employer such as contributions to Social Insurance Schemes, Annual leave, Termination of Employment and Redundancy Law, Provident fund, Health Schemes, etc.; which are imposed either by Law or by agreement with Trade Unions.

EQUIPMENT AND TRANSPORT

- 10) The rates for hire of equipment and transport shall apply only to equipment, which the Contractor has on site, and are to apply for the actual running for which the equipment is employed on work.
- 11) The rates shall include service, operators and necessary attendants, fuel, lubricants and other consumable.
- 12) The Contractor may insert additional items.

MATERIALS

- 13) The rates for materials shall apply to the net amount of materials actually provided, erected and forming part of the works and shall include for delivery to the site of operations.
- 14) The Contractor may insert additional items.

Item	Description	Unit	Rate	
			Foreign	Local
1	Equipment (with operator)			
a.	Mobile Welding set	hr.		
b.	Acetylene cutting equipment	hr.		
c.	Air compressor (180m3/hr. atmosphere) complete with hoses and tools	hr.		
d.	Dump truck 6 Cu.m capacity	hr.		
e.	Crane up to 6 Tonnes lift	hr.		
f.	Drilling equipment	hr.		
g.	Compactor Machine	hr.		
h.	Water Pump	hr.		
i.	Vibrator Machine with poker	hr.		
j.	Small Generator and mobile Lighting Facility	hr.		
k.	Excavator	hr.		
l.	Vibrator Roller	hr.		
m.	Scaffolding Sets	hr.		
n.	Tractor without winch	hr.		
o.	5- tonne lorry	hr.		
p.	2 - tonne lorry	hr.		
q.	5- seater saloon car (or similar)	hr.		
r.	Bulldozer (D6 or similar)	hr.		
s.	Pick-up Truck	hr.		

2	Material			
a.	Cement	ton		
b.	Sand	m3		
c.	Crushed Stone	m3		
d.	Reinforcing Steel	ton		
e.	Imported material for backfilling	m3		
f.	Timber shoring	m2		
g.	Sheet piling	m2		
h.	Gabion walls with mesh	m3		
i.	Turfing of slopes	m2		
j.	150mm-100mm Base course for roads	m3		
k.	50mm-20mm Base for roads	m3		
l.	150mm thick premix-Asphalt layer	m3		
m.	Rubble stones for foundation work (150-300mm dia.)	m3		

SUPERVISORY STAFF RATES

The following rates shall apply where, by agreement with Employer's Representative, supervisory staff are employed on Day works in a direct capacity, i.e. other in their normal supervisory capacity.

The rates also be used as a basis for assessing any legitimate claims for extra costs in accordance with the provision of the Conditions of Contract, where these have not been claimed as Day works.

No payment shall be made without the prior written authority of the Engineer, and the provisions of the Conditions of Contract shall apply to any claim for payment.

The Contractor shall insert in the following schedule descriptions and rates for any class of supervisory staff envisaged which are not already included.

Class of supervisory staff	Normal working Day of 8 Hours
Expatriate	Foreign Currency/ Day
Senior Engineer	
Junior Engineer	
Local	Local Currency/Taka./ Day
Senior Engineer - Civil /Structural	
Junior Engineer - Civil / Structural	
Architect	
Surveyor	
Supervisor	
Foreman	

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT
FOR
DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF

PACKAGE SS-3
UPGRADATION OF THE EXISTING 132KV MADUNAGHAT
SUBSTATION TO 230KV ON TURNKEY BASIS

SCHEDULE C

Form of Times for Delivery & Completion and Contract Completion Times

1.1 Times for Delivery and Completion

The individual dates are all contractually binding.

The times given include all necessary control, relay, metering, auxiliary power and ancillary equipment to enable the respective circuit or item of plant to be completely commissioned and put into commercial operation, together with such other associated equipment, e.g. busbar, etc. as well ensure that subsequent shut-downs are unnecessary or at least only of a temporary or short time nature.

Construction Schedule exceeding 24 months shall be rejected.

The following dates shall be from the commencement date of the Contract.

Key dates to be provided as follows.

- | | | |
|---|---|--|
| E | - | Target completion dates planned by the Contractor |
| D | - | Construction (delivery, erection and commissioning) date guaranteed by the Contractor. |
| C | - | Shipping completion dates guaranteed by the Contractor. |
| B | - | Date of arrival of first shipment guaranteed by the Contractor. |
| A | - | Earliest date by which access is required by the Contractor. |

Site/Descriptions	A Earliest Access Permitted Months	B Months	C Months	D Months	E Months
<u>230/132kV Madunaghat GIS SS</u> (1) Civil works (2) 230kV GIS (3) 230/132/33kV AutoTransformer (4) 132kV Cable (5) SAS (6) Protection (7) AC/DC (8) Tel/SCADA					

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF PACKAGE SS-3 UPGRADATION OF THE EXISTING 132KV MADUNAGHAT SUBSTATION TO 230KV ON TURNKEY BASIS

SCHEDULE D

Proposed Subcontractors/Manufacturers for Major Items of Plant and Services

A list of major items of Plant and Installation Services is provided below.
The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated as per list of equipment and manufacturer's /suppliers.
Bidders are free to propose more than one for each item.

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
1	230 kV Switchgear 230kV GIS Circuit Breaker for GIS Disconnecter for GIS Instrument Transformer for GIS • CT • IVT Surge Arrester AIS type • 230kV • 132kV Post Insulator			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
2	230/132/33 kV AUTO TRANSFORMERS Complete HV bushings LV bushings TV bushings Porcelain for insulators Tap changers Copper Core plates Tanks Radiators Fan motors Temperature indicators Oil valves Pressure relief device Motor control equipment Gas/Oil actuated relay Transformer oil Remote control panel Automatic voltage control equipment Indicating instruments			
3	PROTECTION METERING AND CONTROL			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
4	Panels			
	Instruments			
	Protective relays			
	Substation automation system			
	Meters			
	Transducers			
	DFDR			
	FLEXIBLE CONDUCTOR, RIGID TUBULAR BUS			
	245kV & 132kV			
	Rigid Tubular Bus			
	Flexible Conductor			
	Insulator			
	Fittings and Clamps			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
5	DC EQUIPMENT			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
6	Batteries			
	Chargers			
	Distribution Boards			
7	415 V DISTRIBUTION BOARD			
8	MULTICORE CABLES			
	XLPE Insulated Cables			
	Cable trays			
9	POWER CABLES			
	132kV XLPE Cables			
	132kV Cable sealing ends and Cable termination kits			
10	LV Power cables			
	EARTHING			
	Copper tape			
11	Insulated copper Conductor			
	FIBRE OPTIC MULTIPLEXER EQUIPMENT			
11	SITE ERECTION AND COMMISSIONING			
	Design to be performed by:			
	Civil and Building Works by:			
	Installation Works of			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
	Substation Equipment by: Commissioning Test by:			

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT
FOR
DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF

PACKAGE SS-3
UPGRADATION OF THE EXISTING 132KV MADUNAGHAT
SUBSTATION TO 230KV ON TURNKEY BASIS

SCHEDULE E

TECHNICAL PARTICULARS AND GUARANTEES

PART 1 - SWITCHGEAR

1.1 HV OUTDOOR TYPE GAS INSULATED SWITCHGEAR (GIS)

Sl. No.	Description	Unit	Rated Volatge
			245kV
1.	Type of designation Manufacturer's name & address Enclosure: Busbar Bay Enclosure Material Standard		

6.	Gas compartments No. of gas compartment per feeder (line feeder without busbars, standard configuration) Max. gas losses per gas compartment and year Min. operating period to 1 recharge of SF6 gas Material of filter employed for moisture absorption SF6 filling pressure at 20 °C ambient temp. Min. SF6 service pressure at 40 °C ambient temp. Min. SF6 service pressure at -25 °C ambient temp. Type of gas monitoring Signal: “Loss of SF6 Gas” at 20 °C ambient temp. Signal: “Min. SF6 Density” at 20 °C ambient temp. Type of pressure relief device Material of pressure relief device Setting of pressure relief device	pcs. % year bar bar bar bar bar bar	
7.	Enclosure Mechanical strength of enclosure - Design pressure - Min. bursting pressure Temperature rise of enclosure at rated current - which have to be touched during normal operation - which need not be touched during normal operation - which are not accessible to the operator	bar bar K K K	
8.	Circuit Breaker Enclosure Enclosure material Material of Contacts No. of breaks per phase Rated continuous current at 40 °C ambient temp. (bus coupler feeder) Rated short time breaking current Rated peak withstand current Percentage d.c. component First-pole-to-clear-factor Rated breaking current, small capacitive currents - line charging - cable charging - capacitor bank Rated breaking current, small inductive currents - unloaded transformers - transformer loaded with reactor - shunt reactors Switching overvoltage	pcs. A kA kA % A A A A A A p.u.	

10.	Maintenance Earthing Switch Enclosure Enclosure materials Gas quantity (3 phase) for isolator Operating mechanism - for closing - for opening Max. operating time - for closing - for opening Auxiliary contacts - number (NC/NO/wiping) Rated motor voltage Rated motor power Hand operating facilities	kg sec sec pcs. V d.c. W	
11.	High speed earthing switch Enclosure Enclosure materials Gas quantity (3 phase) for isolator <u>Electrical data:</u> Rated current Rated capacitive breaking current (at 6 kV eff.) Rated inductive breaking current (at 10 kV eff.) <u>Operating mechanism</u> - for closing - for opening max. charging time max. operating time - for closing - for opening Auxiliary contacts - number (NC/NO/wiping) Rated motor voltage Rated motor power Hand operating facilities	kA A A sec ms ms pcs. V d.c. W	
12.	SF6 to Air Bushing Manufacturer Enclosure Enclosure materials Flashover distance Creepage distance	mm mm	

13.	Gas Insulated Current Transformers (a) Transformer bay CT ratio Accuracy class Output (b) Overhead transmission line bay CT ratio Accuracy class Output (c) Bus coupler bay CT ratio Accuracy class Output	Amp. VA Amp. VA Amp. VA	
14.	Gas Insulated Voltage Transformers Ratio Burden Accuracy Class	kV VA	
15.	Circuit Breaker Control Cubicle Material Material thickness Dimensions - Depth - Width - Height	mm mm mm mm	
16.	Separate Local Control Cubicle Material (Steel) Material thickness (1.5) Dimensions - Depth - Width - Height (2,200) Total weight	mm mm mm mm kg	

1.2 HV OUTDOOR AIR INSULATED SWITCHGEARS (AIS)

1.2.6 SURGE ARRESTERS

Sl. No.	Description	Unit	Bidder's Data		
			245kV	145kV	
1	Manufacturer				
2	Model Number				
3	Type:				
4	Continuous operating voltage	kV rms			
5	Rated voltage	kV rms			
6	Standard nominal discharge current	kA			

7	Reference current at ambient temperature	mA			
8	Reference voltage for above	kV rms			
9	Steep current impulse residual voltage	kV pk			
10	Lightning impulse residual voltage at 5kA 10kA 20kA	kV pk kV pk kV pk			
11	Duty Class				
12	Discharge class				
13	Pressure relief class				
14	Nominal diameter of resistor blocks	mm			
15	Number of resistor blocks connected electrically in parallel				
16	Number of separately housed units per phase				
17	Overall height of arrester (without supporting structure)	m			
18	Overall height of arrester including grading ring if applicable	mm			
19	Clearances: phase to earth (from centre line) phase to phase (centre line to centre line)	mm mm			
20	Overall Weight of arrester (without supporting structure)	kg			
21	Maximum cantilever strength	Nm			
22	Maximum force due to wind (at maximum specified gust speed)	Nm			
23	Minimum creepage distance over insulator housing	mm			
24	Insulator shed profile - Reference Document				
25	Terminal palm details - Drawing No.				
26	Earthing terminal - Drawing No.				
27	Type & Description of surge monitoring device				
28	Type test certificate ref/date				
29	Number of the same type of surge arresters supplied to date				

PART 2 – TRANSFORMERS & SHUNT REACTOR

2-1 TRANSFORMER

2-1.1 230/132/33 KV, 225/300 MVA, 3-PHASE POWER TRANSFORMER:

Sl. No.	Description	Unit	Bidder's data
1.1	Name of the Manufacturer		
1.2	Type/Model		
2.1	Continuous Rating - ONAN ONAF OFAF		
2.2	Voltage ratio at no-load HV/LV	kV	
3	Tap Changer		
3.1	HV Tap Changer (On load type) Tapping Range		
3.2	Size of tapping step		
3.3	No. of Steps		
4	Vector Group		
5	On-load voltage control equipment:		
	(A) Type. (B) Manufacturer (C) Range (D) Size of steps (E) Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts (F) Type test certificate reference	% %	
6	Type of cooling		
7	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement	°C	
8	Top oil temperature under service conditions stated in Schedule of Technical Requirement (A) CMR (B) ONAN rating	°C °C	
9	Maximum hot spot temperature rise in core at rated power	°C	

Sl. No.	Description	Unit	Bidder's data
10	Maximum hot spot temperature rise in copper at rated power	°C	
11	Temperature gradient at rating specified	°C	
12	Flux density in iron at normal voltage and frequency and at normal ratio - (no load) (A) Cores (B) Yokes (C) Volts/turn	Tesla Tesla V	
13	Magnetising current (approx) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage at 1.1 x nominal voltage at 1.2 x nominal voltage	% % % %	
14	Harmonic component of magnetising current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	% %	
15.1*	No-load loss (excluding cooling plant losses) at rated voltage, ratio and frequency	kW	
15.2*	Grain Oriented Electrical Steel used: Steel Manufacturer Steel Grade Core Loss at W17/50 Irradiation method	Name Grade Wats/kg	(should be less than or equal to 0.85) (Laser beam or Plasma jet)
16*	Copper loss (excluding cooling plant losses) at 75°C and at rated voltage, ratio (nominal tap),frequency	kW	
17*	Auxiliary loss (Total power input to fans for operation of total installed cooling capacity)	kW	
18	Total loss at 75°C and normal ratio (Sl. No.15+16+17)	kW	
19	Regulation at 75°C and normal ratio - (A) At unity power factor % (B) At 0.8 lagging power factor	% %	

Sl. No.	Description	Unit	Bidder's data
20	(i) Impedance voltage at 75°C and CMR between HV & LV windings (A) at extreme minus tap normal tap extreme plus tap (B) Maximum Impedance over tapping range. Corresponding tap (C) Minimum Impedance over tapping range. Corresponding tap (ii) Impedance voltage at 75°C and CMR between HV & LV at normal tap.	 % % % % %	
21	Equivalent circuit zero sequence impedance: HV-LV	%	
22	Maximum current density in windings at C.M.R. (A) HV winding (B) LV winding (C) SV winding	 A/mm ² A/mm ² A/mm ²	
24	Noise level	dB	
25	Types of transformers (shell or core)		
26	Core steel (a) Type (b) Grade		
27	Types of winding - (A) HV (B) LV		
28	Insulation of (a) HV windings (b) LV windings		
29	Insulation of - (A) Yoke bolts (B) Side plates		
31	Safe working temperature of core plate insulation	°C	
32	Winding connections brazed or crimped		
33	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding	 kN N/m ²	
34	Is facility provided for adjustment		

Sl. No.	Description	Unit	Bidder's data
	of axial pressure on windings	Yes/No	
35	Thickness of transformer tank (A) Sides (B) Bottom	mm mm	
36	Material used for gaskets for oil tight joints		
	Radiators, Valves, Fans		
37	Thickness of radiator plates	mm	
38	Valve type/material: (A) 100mm and below (B) Above 100mm		
39	Equipment for ONAF + cooling state (A) - (A) Radiators on main tank		
40	Number of coolers/radiators or cooler banks per transformer		
41	Number of air blowers per transformer		
42	Speed of air blowers	rpm	
43	Rating of each air blower motor	kW	
44	Starting current of each air blower motor	A	
	Oil Volumes and Weights		
45	Total oil required including cooler system	litres	
46	Volume of oil to fill transformer to above the top yoke	litres	
47	Total volume of conservator	litres	
48**	Weight of active copper	tonnes	
49**	Weight of active iron in core	tonnes	
50**	Weight of core and winding assembly	tonnes	
51**	Weight of each cooler bank complete with oil if mounted separately from transformer	tonnes	
52**	Total weights of complete transformers, including attached coolers, voltage regulating equipment, all fittings and oil	tonnes	

Sl. No.	Description	Unit	Bidder's data		
53	Weight of transformer arranged for transport	tonnes			
54	Manufacture, type and class of oil to IEC 60296				
	Transformer Parts Subject To Short-Circuit Test				
55	Brief description of transformer or parts thereof subjected to short-circuit test				
	Transformer Bushing Insulators		245kV	145kV	36kV
56	Maker				
57	Insulator material (solid, oil-paper etc)				
58	Maker's type reference and rated voltage				
59	Rated current				
60	BCT particulars				
	i) HV Side: Core 1: ii) LV Side: Core 1, 2 & 3: iii) Tertiary Side: Core 1, 2 & 3: iv) Neutral Core 1:				
61	Manufacturer of porcelain				
62	Length of insulator (overall)	mm			
63	Weight of insulator	kg			
64	Electrostatic capacity of complete bushings	pF			
65	Dry lightning impulse voltage withstand (1.2/50 wave)	kV			
66	50Hz wet withstand voltage without arcing horns	kV			
67	Total creepage distance of outdoor shedding	mm			
68	Protected creepage distance of shedding	mm			

*; Subject to Loss Evaluation during the tender stage and guaranteed values subject to deduction from Contract Price

** : Estimated weight. Actual weight shall be measured during execution of the contract and included on the name plate.

PART-3

3.1 XLPE POWER CABLES

Sl. No.	Description	Unit	Bidder's Data
			132 kV
1	Manufacturer		
2	Type		
3	Rated system voltage	kV	
4	Max. permissible system voltage	kV	
5	Rated frequency	Hz	
6	Max. operating current	A	
7	No. of cable		
8	Nominal cross sectional area	mm ²	
9	Impulse withstand voltage	kV	
10	Power frequency withstand voltage	kV	
11	Shape of conductor		
12	Nominal cross section of Cu-screen	mm ²	
13	Thickness of outer sheath	mm	
14	Insulation thickness	mm	
15	Min. bending radius	D	
16	Max. pulling force		
17	Max. DC resistance at 20°C	ohm/km	
18	Max. AC resistance at 20°C	ohm/km	
19	Max. reactance in single configure	mH/km	
20	Operating capacitance	μF/km	
21	Charging current (phase)		
22	Charging load (phase)		
23	Earth fault current	kA	
24	Short circuit rating for 1 sec	kA	
25	Three phase symmetrical fault current for 1 sec	kA	
26	Current rating	kA	
	- in soil	A	
	- in air	A	
27	standard		

3.2 AUXILIARY POWER AND MULTICORE CONTROL CABLES

Item		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of core																
Core section	mm ²															
Core diameter	mm															
Conductor insulation	mm															
Type of filler																
Type of tape																
Sheath thickness	mm															
Sheath outer diameter	mm															
Armour wires	no.															
Armour wires diameter	mm															
Outer covering	type															
Outer covering thickness																
Completed cable:																
diameter	mm															
weight per metre	kg															
maximum drum length	m															
Minimum installed bending radius	mm															
Maximum conductor temperature	°C															

PART 4 - DC EQUIPMENT

4.1 110 V BATTERIES AND CHARGERS

Sl. No.	Description	Unit	Bidder's Data
	Battery		
1	Manufacturer		
2	Type		
3	Electrolyte		
4	Nominal voltage	V	
5	Capacity at 5 hour rate	Ah	
6	Number of cells		
7	Float voltage per cell	V	
8	Battery voltage at end of the duty cycle	V	
9	Normal charging rate	A	
10	Maximum charging rate	A	
11	Ampere-hour efficiency at ten hour rate	%	
12	Ampere-hour efficiency at one hour rate	%	
13	Dimensions of cells	mm	
14	Dimensions of battery complete	mm	
15	Weight of cell complete with electrolyte	kg	
16	Internal resistance per cell when fully charged	ohms	
17	Material of battery case		
	Charger		
18	Manufacturer		
19	Type		
20	AC input voltage and range	kVA	
21	DC output of charger	kW	
22	Type of DC voltage control		
23	Range of DC voltage	V	
24	Output current sharing facility (for parallel operation of chargers)		
25	Regulation	%	
	Charger Cubicle Complete		
26	Manufacturer		
27	Overall dimensions	mm	
28	Total weight	kg	
	DC Switchboard		
29	Manufacturer		
30	Type		
31	Busbars:		
	- maximum current rating	A	
	- dimensions	mm	
32	Boost charge contactors:		
	- manufacturer		
	- maximum current rating		
	- coil rating		
	- method of interlocking		

Sl. No.	Description	Unit	Bidder's Data
33	Alarm relays:		
	- manufacturer		
	- type and reference		
	- power consumption: a) quiescent b) operated	A mA	
34	Number and rating of distribution circuits		
35	Overall dimensions	mm	
36	Total weight	kg	

PART 5 - LV AC EQUIPMENT

SL.No.	Description		Bidder's Data
5.1	Distribution Board		
1	Manufacturer		
2	Manufacturer's type designation		
3	Rating	Amps	
4	Fault Rating for 1 sec	kA	
5	Voltage	Volts	
5.2	Circuit Breakers		
1	Manufacturer		
2	Type		
3	Rating	Amps	
4	Fault Rating for 1 sec	kA	

PART 6 - Digital Fault and Disturbance Recorder [DFDR]

SL. No.	Description	UNITS	BIDDER'S DATA
(A)	GENERAL		
1	Manufacturer's name & address		
2	Type		
3	Power Supply -power Supply for printer	VDC VAC	
(B)	ANALOGUE INPUTS		
1	Number of Channel For Niamatpur : Noagaon : -Expandability		
2	Nominal Current	Amp	
3	Nominal voltage - Current	Vac/Vdc mA/Amp	
4	Frequency response		
5	Cut-off frequency		
	(a) Bandwidth	dB	
	(b) Attenuation at	dB	
	(c) Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	
	(d) Simultaneously programmable sampling rate for all feeders/inputs -Locally Changeable -Remotely Changeable	Yes/No Yes/No	
	(e) Possible sampling rates	Samples/sec	

SL. No.	Description	UNITS	BIDDER'S DATA
		Samples/sec Samples/sec	
6	DC coupled inputs	Yes/No	
7	Resolution	bits	
8	Accuracy	%	
9	Burden 1. Current Circuit at IN 2. Voltage Circuit	VA VA	
10	Over load 1. Current 2. Voltage circuit	% In % Vn	
(C)	DIGITAL INPUTS		
1	Number of Channel -Expandability (Without and time skew)		
2	Selectable input level	Vdc	
3	Type		
4	Resolution	ms	
(D)	MEMORY		
1	Size	MB	
2	Type		
3	Pre-fault time (fast scanning rate)	sec	
4	Post-fault (fast scanning rate)	sec	
5	Pre and Post-fault time (slow scanning rate)	sec	
6	In-Built hard disk (auto-maintained)	GB	
(E)	SENSORS/ TRIGERRING CRITERIA		
	All sensors/trigerrrs are preferable Programmable and Virtually recordable	Yes/No	
1.	Logical combination sensor	Yes/No	
2.	Three phase over or under Voltage / Current	Yes/No	
3.	Mono phase over or under Voltage / Current	Yes/No	
4.	*du/dt, dp/dt, dq/dt, [Single/3 Phases], df/dt. etc.	Yes/No	
5.	RMS [Voltage / Current]	Yes/No	
6.	Zero Sequence	Yes/No	
7.	Negative, Positive Sequence	Yes/No	
8.	Frequency	Yes/No	
9.	DC Step	Yes/No	
10.	Pendling / Swing	Yes/No	
11.	Digital level and edge	Yes/No	
12.	Sensor trigger	Yes/No	
13.	Event Trigger	Yes/No	
14.	Manual Trigger	Yes/No	
15.	Remote Trigger	Yes/No	
(F)	CLOCK SYSTEM		
1.	Internal Clock	Yes/No	
2.	Accuracy		
3.	External Synchronization	Yes/No	
4.	Time resolution between 2 synchronized pulses		
(G)	OUTPUT ALARM RELAY CONTACT		
1.	Max. operation Voltage DC/AC	Vac / Vdc	
2.	Make and carry for 0.5 sec	A	
3.	Carry Continuously	A	
4.	Break (DC) – resistive	W	

SL. No.	Description	UNITS	BIDDER'S DATA
(H)	INTERFACE FOR DATA COMMUNICATION		
1.	Full definition compression	Yes/No	
2.	Maximum transmission rate	bits / Sec	
3.	Standard serial port (EIA-232-D)	Yes / No	
4.	Printer Port	Yes/No	
5.	Dedicated serial port for modem	Yes/No	
(I)	PRINTER DATA		
1.	Printer amplitude (scaling peak to peak)		
2.	Time Scal (mm / s)		
3.	Printer resolution	mm	
4.	Auto printing	Yes/No	
(J)	Fault Priority transmission	Yes/No	
(K)	Fault location (distance calculation)	Yes/No	
(L)	Test certificates from internationally recognized Laboratories	Yes/No	
(M)	COMMUNICATION AND REMOTE ANALYZING UNIT		
	1. Processor Pentium	(MHz) Yes/No	
	2. Co-Processor pentium	Yes/No	
	3. Main memory capacity	(Mb) Yes/No	
	4. Color graphics board S-VGA	Yes/No	
	5. Screen S-VGA	Yes/No	
	6. Hard disk unit	Yes/No	
	7. Printer	Yes/No	
	8. Modem	Yes/No	
*Note: du/dt=Change of voltage, dp/dt=Change of active power, dq/dt=change of reactive power, df/dt=Change of frequency.			

PART 7 - SUBSTATION AUTOMATION SYSTEM

Sl. No.	Description	Unit	Bidder's Data
1	General Requirement:		
	Standards to be complied with Substation Automation system		
	Test Ca. Damp heat steady state		
	Test Db and guidance; Damp heat cyclic		
	Digital I/O, Analogue I/O dielectric Tests		
	Digital I/O, Surge withstand test		
	Radio interference test		
	Transient fast burst test		
	Static Discharge		
	Electromagnetic fields		
	Temperature range (min/max)	°C	
	Relative humidity	%	
	Intelligent Electronic Devices (IED's)		
	- serial communication interface included?		
	- Protection & Control IED's connected same bus?		
	- self monitoring		

Sl. No.	Description	Unit	Bidder's Data
	- display of measured values		
	- remote parameterization		
	- disturbance record upload and analysis		
	Availability Calculation shall be furnished for each equipment as well as for the entire system		
	Main system, HMI, Gateway, IEC have dual communication port		
	SNTP server provide GPS time synchronization to HMI, Gateway, IE D		
	System topology		
2	Detailed Requirements:		
	Manufacturer of Substation Automation System		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered system. (Note: proof of experience should be furnished. The components used in the offered system and those with field experience should be the same)	Yrs.	
	Design life of substation Automation System	Yrs.	
	Manufacturers quality assurance system		
	Dimensions of cubicle: - Width - Depth - Height - Floor load	mm mm mm N/m ²	
3	Station Level Equipment:		
	Station Controller		
	MTBF (Mean time between Failures)		
	MTTR (Mean time to repair)		
	Station computer dual connection to Ethernet		
	Dual wide screen monitor	inch	
	Dual Station Computers Provided in redundant hot Standby		
	Hot standby take over time		
	Annunciator for Station PC system software		
	Number of years of proven field experience of offered software	Yrs.	
	Operating System		
	All standard picture as per spec included in HMI		
	Process Status Display & Command Procedures		
	Event processing as per spec		
	Alarm processing as per spec		
	Reports as per spec		
	Trend Display as per spec		
	Graphical Fault I information receiving function		
	Disturbance & Fault recording and analysis with graphical format		
	User Authority levels as per spec		

Sl. No.	Description	Unit	Bidder's Data
	System supervision & monitoring as per spec		
	Automatic sequence control as per spec		
4	Gateway to National Load dispatch Center		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven filed experience of offered unit	Yrs.	
	Insulation tests		
	Fast disturbance tests		
	Industrial environment		
	Industrial grade hardware with no moving parts (PC based gateway is not accepted)		
	Design life of offered equipment	Yrs.	
	Redundant communication channel		
	Redundant CPU		
	Redundant DC/DC Supply		
	MTBF (Mean time between Failures)		
	MTTR (Mean time to repair)		
	Dual connection to Ethernet		
5	Station Bus:		
	Type of bus/protocol		
	Physical Medium		
	Dual connection		
	Transfer rate/bus speed		
6	Interbay Bus		
	Type of bus/protocol		
	Physical Medium		
	Transfer rate/bus speed		
7	Printer server		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	MTBF		
8	Event Printer		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Print speed		
	Paper feed/width		
	Character set		
	MTBF		
9	Hard Copy colour Printer		
	Manufacturer		
	Name and type of product in supplier's catalogue		

Sl. No.	Description	Unit	Bidder's Data
	Origin of manufacturer		
	Print speed		
	Colours		
	Resolution		
	Character set		
	MTBF		
10	Master Clock GPS (Global Positioning System) Receiver:		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Stability		
	MTBF		
11	Bay control Unit - HV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered unit	Yrs.	
	Separate Bay controller unit provided for each bay & feeder		
	Type of bay controller offered HV/MV		
	Select Before Operate with Open Execute & Close Execute		
	Single bit dependence		
	Interlocking, bay & Station wide		
	Dual connection to Ethernet sw		Not applicable
	Synchrocheck function: - Maximum Voltage difference - Maximum Frequency difference - Maximum Phase difference		
	Double command blocking		
	Independent settable parameter groups		
	Local Display Unit		
	Sequence of event recorder: - Events - Time resolution		
	Disturbance recorder function		
	Disturbance record transfer function		
	Comtrade file generation		
	Comprehensive self-supervision		
	Battery free backup of events and disturbance records		
	Insulation tests		
	Fast disturbance tests		
	MTBF		
	MTTR		

Sl. No.	Description	Unit	Bidder's Data
	Temperature range: IED's		
	- Operation	°C	
	- Transport and storage	°C	
	Relative humidity:		
	- Operating max./min.	%	
	- Transport and storage	%	
12	Back up control mimic -HV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Control functionality: Control of breaker as well as all isolators/earthing switch (Control functionality should not be affected if bay controller fails)		
	Key-Locked		
	Interlock override function		
	Separate backup control mimic provided for each bay & feeder		

PART 8 - FIBRE OPTIC MULTIPLEXER EQUIPMENT

SL. No.	Description	Unit	Bidder's Data
1	GENERAL:		
	Manufacturer		
	Model No.		
	Type		
	Type of multiplexer		
	Complying to ITU-T rec.		
	Transmission Capacity	Mbit/s	
	Access capacity on 64 kbit/s	channels	
	Access capacity on 2 Mbit/s	channels	
	Redundant central processor		
	Digital cross connect function		
2	Available AGGREGATES:		
	Optical aggregates (ITU-T G.957)		
3	Available TRUNK INTERFACES:		
	HDB3, 2 Mbit/s interfaces per module	No.	
	Complying to ITU-T rec.		
	HDSL, 2Mbit/s interface: no of copper wires - Capacity on 2Mbit/s or on 1Mbit/s - Capacity selectable	No. ch / pair of wire	
4	Available USER INTERFACES		
5	Voice interfaces for trunk lines:		
	1 + 1 com path protection, available for all		
	Analogue, 4wire with E&M: Input level Output level	dBr dBr	

SL. No.	Description	Unit	Bidder's Data
	Analogue, 2wire with E&M: Input level	dBr	
	Output level	dBr	
	Digital, 2Mbit/s CAS or PRI		
6	Voice interfaces for remote Subscriber:		
	2wire, subscriber side	dBr	
	2wire, PABX side	dBr	
7	Integrated teleprotection		
8	Interface for Commands:		
	Number of independent commands	No.	
	Transmission time max.	ms	
	Signal voltage	Vpeak	
	1 + 1 com path protection		
9	Interface(s) for Differential Protection:		
	Electrical interface: G.703	kbit/s	
	Optical Interface	kbit/s	
10	Data: channels per module		
	1 + 1 com path protection, available for all		
	V.24/V.28 (RS-232): up to 38.4kbit/s	No.	
	V.11/X.24 (RS-422): 64kbit/s	No.	
	V.35: 64kbit/s	No.	
	V.36 (RS-449): 64kbit/s	No.	
	G.703: 64kbit/s	No.	
	Ethernet: 10/100 BaseT	No.	
	WAN capacity	Mbit/s	
	Protocols	Mbit/s	
11	Integrated alarm gathering module:		
	Number of external alarms per module	No.	
	Auxiliary power supply for ext. contacts		
12	Network Management System		
	Type/Name of configuration tool		
	For fault / configuration management		
	For local / remote operation		
	Data communication network (DCN)		
13	Ambient Conditions:		
	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	
	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	
	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	
14	Power Supply		
	Operation	VDC	
	Fully redundant power supply		

Bidder shall provide all necessary information which deems to be necessary to complete the project in all respects.

PART 9 – PROTECTION

9.1 230kV Line Differential Protection (Main 1)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Range of operating coil settings	% of CT rating	
4	Range of bias coil settings	% of CT rating	
5	Recommended operating coil setting	% of CT rating	
6	Recommended bias coil settings	% of CT rating	
7	Number of bias coils		
8	Minimum sensitivity: Earth faults/Phase faults	% of CT rating	
9	Maximum through fault at which the protective equipment is stable with recommended settings: Earth faults/Phase faults	% of CT rating	
10	Inter trip: Operating time/Reset time	ms	
11	Permissive inter trip:		
	Time delay setting	ms	
	Operating time after delay setting	ms	
	Reset time	ms	
12	Maximum time delay between initiation of fault and emerging of breaker trip circuit		
13	Current transformer requirement		

9.2 230kV Distance Protection (Main 2)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Phase switched		
4	Zone switched		
5	Number of zones		
6	Shape of impedance characteristic: Zone 1/Zone 2/Zone 3		
7	Reverse looking element (blocking signal initiation)		
8	Sensitivity:		
8.1	Minimum operation current: Earth faults/Phase faults	A	
8.2	Minimum necessary voltage for fault at Zone 1 reach point (if applicable): Earth faults/Phase faults	V	
8.3	Minimum Zone 1 ohmic impedance to which relay can be set	ohms	
8.4	Maximum Zone 1 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.5	Minimum Zone 2 ohmic impedance to which relay can be set	ohms	
8.6	Maximum Zone 2 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.7	Maximum Zone 3 ohmic reach:	ohms	

SL. No.	Description	Unit	Bidder's Data
	Forward reach/Reverse reach		
9	Arc forward and reverse reach setting independent of each other?	Yes/No	
10	Can resistance and reactance reaches be set independent of each other	Yes/No	
11	Directional sensitivity	V	
12	Current transformer requirements		
13	Voltage transformer requirements		
14	Back up Zone time ranges: Zone 2/ Zone 3	sec.	
15	Method used to clear close-in faults:		
	which occur when line is already energized in service		
	which exist upon line energization		
16	Has distance protection previously been used in the type of blocking scheme offered for this contract? If yes: number of scheme in service/year first in service	Yes/No	
17	Approximate number of years distance relay in service (A complete reference list should be submitted stating client, system voltage and year of going into service).		
18	Zone 1 operating times on fault position:		
	Earth faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Phase to phase faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Three phase faults: 0, 50, 90% of relay setting	ms (min./max.)	

9.3 230 kV Line Distance Protection (Backup 1, Backup 2)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Phase switched		
4	Zone switched		
5	Number of zones		
6	Shape of impedance characteristic: Zone 1/ Zone 2 / Zone 3		
7	Reverse looking element (blocking signal initiation)		
8	Sensitivity:		
8.1	Minimum operation current: Earth faults/Phase faults	A	
8.2	Minimum necessary voltage for fault at Zone 1 reach point (if applicable): Earth faults/Phase faults	V	
8.3	Minimum Zone 1 ohmic impedance to which relay can be set	ohms	
8.4	Maximum Zone 1 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.5	Minimum Zone 2 ohmic impedance to which relay can be set	ohms	
8.6	Maximum Zone 2 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.7	Maximum Zone 3 ohmic reach: Forward reach/Reverse reach	ohms	

SL. No.	Description	Unit	Bidder's Data
9	Arc forward and reverse reach setting independent of each other?	Yes/No	
10	Can resistance and reactance reaches be set independent of each other	Yes/No	
11	Directional sensitivity	V	
12	Current transformer requirements		
13	Voltage transformer requirements		
14	Back up Zone time ranges: Zone 2/ Zone 3	sec.	
15	Method used to clear close-in faults:		
	which occur when line is already energized in service		
	which exist upon line energization		
16	Has distance protection previously been used in the type of blocking scheme offered for this contract? If yes: number of scheme in service/year first in service	Yes/No	
17	Approximate number of years distance relay in service (A complete reference list should be submitted stating client, system voltage and year of going into service).		
18	Zone 1 operating times on fault position:		
	Earth faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Phase to phase faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Three phase faults: 0, 50, 90% of relay setting	ms (min./max.)	

9.4 230kV Line Directional Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Current setting range: Forward element/Reverse element	A	
4	Minimum polarizing quantity required for correct directional decision:		
	Voltage: Forward element/Reverse element	V	
	Current: Forward element/Reverse element	V	
5	Characteristic angle	Degree	
6	Time ranges: Blocking scheme/Back up	sec	
7	Has protection previously been used in the blocking scheme offered for this contract?	Yes/No	
8	Current transformer requirements		

9.5 230 kV Busbar Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Operating principle, e.g. high impedance		
4	Minimum relay setting	A	
5	Sensitivity of scheme (allowing for CT magnetizing current, etc.)		

6	Maximum through fault current at which protection is stable	A	
7	Current transformer requirements		
8	Estimated magnetizing current at relay setting	A	
9	Operating time at twice relay minimum setting	ms	
10	Operating time at ten times relay minimum setting	ms	

9.6 230/132/33 kV Transformer Biased Differential Protection (87)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Range of operating coil settings	% of CT rating	
4	Range of bias coil settings	% of CT rating	
5	Recommended operating coil setting	% of CT rating	
6	Recommended bias coil setting	% of CT rating	
7	Number of bias coils		
8	Minimum sensitivity: Earth faults/Phase faults	% of CT rating	
9	Maximum through fault at which the protective equipment is stable with recommended settings: Earth faults/Phase faults	% of CT rating	
10	Maximum time delay between initiation of fault and emerging of breaker trip circuit	ms	
11	Current transformer requirements		

9.7 230/132/33 kV Transformer Restricted Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Operating principle, e.g. high impedance		
4	Minimum relay setting	A	
5	Sensitivity of scheme (allowing for CT magnetizing current, etc.)		
6	Maximum through fault current at which protection is stable	A	
7	Current transformer requirements		
8	Estimated magnetizing current at relay setting	A	
9	Operating time at twice relay minimum setting	ms	
10	Operating time at ten times relay minimum setting	ms	

9.8 230/132/33 kV Transformer Inverse Time Overcurrent & Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Inversed time element		
	Range of current settings: Overcurrent/Earth Fault	A	
	Range of operating times at highest timing setting at ten times current setting	sec.	
	Range of operating times at highest timing	sec.	

	setting at twice current setting		
4	High set instantaneous element range of settings: Overcurrent/Earth Fault	A	
5	Transient overreach at X/R=10		
6	Operating time with Maximum offset current at five times current setting	ms	
7	Burden of relay on minimum inverse time element current setting at a current ten times setting: Overcurrent/Earth fault	VA	

9.9 230/132/33 kV Transformer Directional Overcurrent and Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Current setting range: Forward element/Reverse element	A	
4	Minimum polarizing quantity required for correct directional decision:		
	Voltage: Forward element/Reverse element	V	
	Current: Forward element/Reverse element	V	
5	Characteristic angle	degrees	
6	Current transformer requirements		

9.10 Breaker Failure Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Setting of current elements: Phase faults/Earth faults	A	
4	Timer setting range	sec.	
5	Burden of relay at minimum current setting at ten times CT secondary rated current during: Phase faults/Earth faults	VA	
6	Operating time/Reset time	ms	

9.11 Tripping Relays

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Nominal operating voltage	V	
4	Minimum operating voltage	V	
5	Operation indicator		
6	Operating time at nominal voltage	ms	
7	Contact rating:		
	Make and carry continuously	VA	
	Make and carry for 3 sec.	VA	
	Break: resistive	W	

SL. No.	Description	Unit	Bidder's Data
	inductive	VA	

9.12 Overall Fault Clearance Times

SL. No.	Description	Unit	Bidder's Data
1	230 kV Busbar Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
2	230/132/33 kV Transformer Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time	ms	
	Circuit breaker time	ms	
	Total	ms	
3	230 kV Line Faults:		
	Current Differential protection maximum operating time	ms	
	Distance protection maximum operating time	ms	
	Permissive scheme time delay	ms	
	Auxiliary relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	

PART 10– OTHERS

Sl. No.	Description	Unit		245kV	145kV
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Sl. No.	Description	Unit		245kV	145kV
1	Structural Steel				
	Type and standard specification				
	Manufacturer and country				
	Minimum yield strength	kg/mm ₂			
	Ultimate tensile strength	kg/mm ₂			
2	Copper Conductors for Earthing system				
	Type and standard specification				
	Manufacturer and country				
	Conductor material				
	Size of conductors (Solid copper rods)	mm ²			
	Size of conductors (Flat copper bars) (Width × Thickness × Bundles)	mm			
	Rated current	A			
	Short time withstand current	kA rms			
	Peak withstand current	kA pk			
3	High Voltage Bus Work				
3.1	Switchyard Conductor				
3.1.1	Copper Tubular Conductors for Busbar				
	Type and standard specification				
	Manufacturer and country				
	Inner diameter	mm			
	Outer diameter	mm			
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Weight	kg/m			
	Moment of inertia	kg-m ²			
3.1.2	Aluminium Tubular Conductors for Busbar				
	Type and standard specification				
	Manufacturer and country				
	Inner diameter	mm			
	Outer diameter	mm			
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	- Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Weight	kg/m			
	Moment of inertia	kg-m ²			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			

Sl. No.	Description	Unit		245kV	145kV
	Peak withstand current	kA pk			
	Rated ultimate tensile strength	kN			
	Mass, nominal	kg/m			
	No. of conductors per bundle				
	Bundle configuration				
	Bundle spacing				
3.1.3	Flexible Bus Conductor				
	Type and standard specification				
	Manufacturer and country				
	Conductor type				
	Conductor size				
	Standing - No. of Al wires - Dia. Of each wire	mm			
	Overall conductor dia.	mm			
	Cross-sectional area	mm ²			
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Rated ultimate tensile strength	kN			
	Mass, nominal	kg/m			
	No. of conductors per bundle				
	Bundle configuration				
	Bundle spacing				
3.1.4	Shield Wire				
	Type and standard specification				
	Manufacturer and country				
	Dia. of galvanized steel wire	mm			
	Stranding - No. of Al wires - Dia. Of each wire	mm			
	Grade of wire				
	Weight of wire	kg/km			
	Minimum breaking strength of wire	kN			
3.2	Insulators				
3.2.1	Station Post Type (for rigid Busbar)				
	Type and standard specification				
	Manufacturer and country				
	Insulator unit, length/height	mm			
	No. of units in each insulator				
	Power frequency flashover voltage - Dry - Wet	kV kV			

Sl. No.	Description	Unit		245kV	145kV
	Impulse flashover voltage				
	- Positive	kV			
	- Negative	kV			
	Power frequency withstand voltage				
	- 1 min. dry	kV			
	- 10 sec. wet	kV			
	Power frequency puncture voltage	kV			
	Switching impulse withstand voltage, wet	kV pk			
	Lightning impulse withstand voltage	kV pk			
	Radio interference voltage				
	- Test voltage to ground	kV rms			
	- Max. RIV at $1.1xU_r/3$ line to ground voltage, when tested as per IEC 60694	micro V			
	Leakage distance	mm			
	Mechanical values, failing load (min.)				
	- Cantilever strength	N			
	- Tensile strength	N			
	- Torsional strength	N-m			
	- Compressional strength	N			
	- Combined electrical and mechanical strength	N			
	- Impact strength	N-m			
3.2.2	String Type				
	Type and standard specification				
	Manufacturer and country				
	Insulator unit, length	mm			
	No. of units in each insulator				
	No. of insulator strings per conductor (at each end)				
	Dia. of disc	mm			
	Disc spacing	mm			
	Power frequency flashover voltage				
	- Dry	kV			
	- Wet	kV			
	Impulse flashover voltage				
	- Positive	kV			
	- Negative	kV			
	Power frequency withstand voltage				
	- 1 min. dry	kV			
	- 10 sec. wet	kV			
	Power frequency puncture voltage	kV			
	Switching impulse withstand voltage, wet	kV pk			
	Lightning impulse withstand voltage	kV pk			
	Dry arcing distance	mm			

Sl. No.	Description	Unit		245kV	145kV
	Radio interference voltage - Test voltage to ground - Max. RIV at $1.1xU_r/3$ line to ground voltage, when tested as per IEC 60694	kV rms micro V			
	Leakage distance	mm			
	Mechanical values, failing load (min.) - Tensile strength - Torsional strength - Compressional strength - Combined electrical and mechanical strength - Impact strength	N N-m N N N-m			
3.3	Clamps and Fittings				
	Type and standard specification				
	Manufacturer and country				
	Maximum working stresses				
	All accessories for installation (bolts, nuts, etc.)				

PART -12

13.0 CCTV

Sl. No	Description	
13.1	CCTV	
1.	Manufacturer's name and address	
2.	Country of origin	
3.	Type	
4.	Model No.	
5.	Screen in Control room	
6.	Colour monitor	
7.	100% duty cycle video surveillance system (not domestic type)	
8.	Pre-programmed sequence	
9.	Select/deselect and control any camera	
10.	Control pan/tilt/zoom/focus function	
11.	Image Sensor (Camera)	
12.	Line Horizontal resolution(Camera)	
13.	S/N Ratio of video signal (Camera)	
14.	Electric light control (Camera)	
15.	Video output signal (camera)	
16.	Back Light Compensation (camera)	
17.	Tilt range	
18.	Tilt speed	
19.	Pan range	
20.	Panning speed	
21.	Zoom operation speed & focus operation (lenses)	
22.	IP Rating of Camera Housing, pan, tilt assembly	
23.	Supply voltage	
13.2	Digital Video Recorder	
1.	Number of channels	
2.	Video compression	
3.	Hard disk capacity	
4.	Video monitor size	

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SUBSTATION TO 230KV ON TURNKEY BASIS**

SCHEDULE F

PROPOSED SUBCONTRACTORS

Form of Manufacturers' and Subcontractors' Statement of Experience

1.1 Bidder's Statement of Previous Experience for Civil Works for Substations

Bidder is to complete this schedule giving details of substation contract of the same type of construction as this contract and which they have completed or which are in the course of completion by them. Failure to complete this schedule with full satisfactory details and documentary proof will render the offer liable to rejection.

Name of the Project					
Contract No.					
Country					
Highest Voltage 230kV and above voltage					
Type of Construction					
Name of Employer					
Consultant					
No. of 230kV Bays & Cap. of Transformer MVA x Units					
Contract Award Date					
Contractual Completion Date					
Actual Completion Date					
Contract Value					

1.2 Subcontractor's Statement of Experience for Civil Works for Substations

Item	Element of work	Approximate value (% of Total Contract Price)	Name and address of Subcontractor	Statement of Similar Works executed

The Bidder shall enter in this schedule a list of the sections and appropriate value of the work for which the purposes to use subcontractors, together with the names and addresses of the proposed subcontractors. The Bidder shall also enter a statement of similar works

Previously executed by the proposed subcontractors, including description, location and value of works, year completed, and name and addresses of the Employer. Notwithstanding such information the bidder, if awarded the contract, shall remain entirely and solely responsible for the satisfactory completion of the Works.

2.1 Bidder's Statement of Previous Experience for Procurement, Delivery, Design, Installation, Testing and Commissioning for the Substations

Bidder is to complete this schedule giving details of substation contract of the same type of construction as this contract and which they have completed or which are in the course of completion by them. Failure to complete this schedule with full satisfactory details and documentary proof will render the offer liable to rejection.

Name of the Project					
Contract No.					
Country					
Highest Voltage 230kV and above voltage					
Type of Construction					
Name of Employer					
Consultant					
No. of 230kV or above voltage Bays & Cap. of Transformer x Units					
Contract Award Date					
Contractual Completion Date					
Actual Completion Date					
Contract Value					

2.2 Subcontractor's Statement of Experience for Procurement, delivery, Design Installation, Testing and Commissioning for the Substations

Item	Element of work	Approximate value (% of Total Contract Price)	Name and address of Subcontractor	Statement of Similar Works executed

The Bidder shall enter in this schedule a list of the sections and appropriate value of the work for which the purposes to use subcontractors, together with the names and addresses of the proposed subcontractors. The Bidder shall also enter a statement of similar works.

Previously executed by the proposed subcontractors, including description, location and value of works, year completed, and name and addresses of the Employer. Notwithstanding such information the bidder, if awarded the contract, shall remain entirely and solely responsible for the satisfactory completion of the Works.

Signature -----
Date -----

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SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

Price Adjustment Formula

Prices payable to the Contractor, in accordance with the Contract, shall be subjected to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula. Each percentage of the formula (except the fixed element) can be changed by the Contractor.

(1) Transformer and Shunt Reactor

$$P_1 = P_0 \times \left(a + b \frac{L_1}{L_0} + c \frac{M_{11}}{M_{01}} + d \frac{M_{12}}{M_{02}} + e \frac{M_{13}}{M_{03}} + f \frac{M_{14}}{M_{04}} \right) - P_0$$

Where,

- P_1 = Price Adjustment amount of power transformer and shunt reactor, payable to the Contractor
- P_0 = Contract Price (base price)
- a = percentage of fixed element in Contract Price ($a = 15\%$)
- b = percentage of labour component in Contract Price ($b = 20\%$)
- c = percentage of material Core (Si steel) component in Contract Price ($c = 22\%$)
- d = percentage of material (Copper) component in Contract Price ($d = 25\%$)
- e = percentage of material (Steel) component in Contract Price ($e = 15\%$)
- f = percentage of material (Zinc) component in Contract Price ($f = 3\%$)
-
- L_0, L_1 = labour indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively
- M_{01}, M_{11} = material (Core, Si steel) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively
- M_{02}, M_{12} = material (Copper) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively
- M_{03}, M_{13} = material (Steel) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively
- M_{04}, M_{14} = material (Zinc) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

Conditions Applicable To Price Adjustment

The Bidder shall indicate the source of labor and materials indices and the base date indices in its Bid.

Item	Country of Origin; Currency of index	Source of Indices Used Title / definition	Base Date Indices Value Date
L ₀ , L ₁ (Labour)			
M ₀₁ , M ₁₁ (Si Steel)			
M ₀₂ , M ₁₂ (Copper)			
M ₀₃ , M ₁₃ (Steel)			
M ₀₄ , M ₁₄ (Zinc)			

The Base Date shall be the date twenty eight (28) days prior to the Bid opening date.

The date of adjustment shall be the mid-point of the sequences shown in the Program of Performance submitted by the Bidder, pursuant to GC 18.2, from design until the end of manufacture of the transformer and shunt reactor.

The following conditions shall apply:

- (a) No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay;
- (b) If the currency in which the Contract Price, P_0 , is expressed is different from the currency of the country of origin of the labor and/or materials indices, a correction factor will be applied to avoid incorrect adjustments of the Contract Price. The correction factor shall correspond to the ratio of exchange rates between the two currencies on the base date and the date for adjustment as defined above; and
- (c) No price adjustment shall be payable on the portion of the Contract Price paid to the Contractor as an advance payment.

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SCHEDULE H

PROPOSED CONTRACT & SITE ORGANISATION

Bidders should provide the names of suitably qualified personnel to meet the requirements specified in Section 3 (Evaluation and Qualification Criteria) of Volume 1 of 3 of the Bidding Document. The data on their experience should be supplied using Form PER-1 and PER-2 in Volume 3 of 3 in the Bidding Documents.

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SCHEDULE I

**DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER AND
AFTER CONTRACT**

1 DRAWINGS AND DOCUMENTATION

1.1 Technical Drawings/Documents

1.1.1 General

The Contractor shall prepare necessary technical documents for the equipment including detailed engineering drawings, design calculations and specifications showing full details of the civil works, equipment and materials to be used as well as all arrangement necessary for the installation works.

Prior to manufacturing, the contractor shall submit technical documents and drawings to the Employer for approval.

The Employer will review and send to the Contractor his comments on the documents within 4 weeks from receiving them, the commented drawings/ documents will be marked by “Approved”, “Approved with Conditions”, “Not Approved” or “Not Subject for Approved”.

Any comments given by the Employer shall be taken into account before commencement of civil works, manufacturing process at factories and if any modification or change is directed by the Employer, the documents shall be revised and resubmitted for approval after making necessary revisions (Within 14 days).

Approval of the documents shall in no way relieve the Contractor from any of his contractual obligations.

All costs and expenses for preparation and submission of the documents shall be borne by the Contractor including those for revision and submission of the documents.

The Technical documents shall have the followings features:

- a) Units:
International System of Units (SI) shall be applied to all works.
- b) Language:
English shall be the formal language, hence all documents, correspondences, drawings, reports, schedules, instructions, name plates, rating plates, caution plates and notices shall be written in English.
- c) Symbols, Marks and Abbreviations:
All symbols, marks and abbreviations, etc., used on any documents shall be clearly explained by a legend on the same document or on separate sheets.

The abbreviations and marks used for an individual device shall be identical throughout whole documentation so as to avoid confusion and misunderstanding.

- d) Sizes and Identifications of Documents:

The size of the drawings shall be standardized as follows:

- A1 (594 mm x 841 mm)
- A2 (420 mm x 594 mm)
- A3 (297 mm x 420 mm)
- A4 (210 mm x 297 mm)

Design calculations, specifications, lists, instruction manuals and other documents shall preferably be prepared and submitted in A4 size.

All documents shall have a uniform title block at the bottom right hand corner, inclusive of the origin of the documents. The title block shall show the drawing title with main ratings such as capacity or voltage etc., drawing number, revision number or letter, date to have been prepared, name of the Contractor and/or manufacturer and the signature of the Contractor's authorized representative. Project title block will be informed from Engineer after contract. A spare blank space shall be provided above the title block of each document for the Employer comments.

1.1.2 Typical Technical Documents Required to be Submitted to the Employer:

The Bidder/Contractor shall submit the following technical documents and drawings:

- A) With the Bid: (Refer to also Item 2 followings)

The following drawings shall be submitted with the Bid:

- a) General arrangement of substation.
This drawing shall give the principal dimensions and approximate positions of the circuit breakers, isolating switches, etc.
- b) General arrangement and overall dimension drawings of the switchgear.
- c) Single line diagram of the main connections with secondary circuit of protection and metering etc.
- d) General arrangement for transformers.
- e) General arrangement of control and indicating panels.
- f) General arrangement of relay panels
- g) Drawings for MV switchgear & auxiliary buildings and guard house including floor plan, section, elevation and dimensions.
- h) Catalogues, literature and reference list of proposed Switchgear equipment, protection relays and SAS.
- i) Quality Management System Manual and ISO Certificate of the equipment manufacturer for 230kV GIS, Auto Transformer, Protection relays, Battery and Battery charger, Communication equipment and SAS.
- j) Type testing certificates and procedures for similar switchgear, transformer, shunt

reactor, circuit breaker, cable, etc.

- k) Routine testing certificates and procedures for all equipment.

B) After Contract Award Stage:

The followings are minimum requirement. Additional documents/drawings shall be submitted to the Employer, when required by the Employer.

a) Master List of Drawings and Documents (Master Document List):

After contract signing, the Contractor shall create and submit a master list of drawings and documents to the Employer for approval, for the purpose of monitoring and smooth processing of document approval, which shall contain document title and number, date to be submitted, re-submission date, approval date etc. underneath each column of relevant document classification or category.

- i) Single Line diagram (SLD) for main circuits and secondary circuits.
- ii) Layout drawings of the substation showing buildings/rooms, equipment arrangement, overall dimensions of equipment bays, cable routes or connections between equipment, internal/access roads and phase-phase and phase-earth clearances where applicable.
- iii) Outline drawings of switchgear bays, circuit breakers, disconnecting switches, earthing switches and other main plant showing overall dimensions and weights, including details for shipping.
- iv) General arrangement for transformers and shunt reactors.
- v) Bushings or cable termination details for switchgears and transformers/reactors.
- vi) Descriptive information and drawings for transformers, dealing with tank, core and winding arrangements including type of coils, insulation, use of grading, on-load tap-changing equipment and location of all ancillary devices, these drawings shall show masses crane lift necessary for un-tanking and size of lifting lugs.
- vii) Typical drawings of protection equipment, relay panels, and associated equipment enclosures.
- viii) SAS system configuration and related drawings
- ix) AC/DC system and panels arrangement drawing
- x) Telecommunication equipment system diagram & panel arrangement
- xi) Detailed schematic diagram for all equipment
- xii) Interconnection/Wiring Diagrams, Cables route & Cable schedule between panels/equipment
- xiii) Civil Engineering/design drawings
- xiv) Details of Building services equipment and system arrangement/calculations
- xv) Others, when required
- The contractor shall include any other drawings, catalogues, descriptions and photographs necessary to present a clear picture of the type and class of equipment to be provided under the contract.
- Project Implementation Schedule/Program shall be submitted to the Employer for approval within one month after signing the contract, showing the detailed program time schedule in bar/Gantt chart or equivalent for design, manufacturing, civil works, factory testing, delivery to substations, installation, site tests/commissioning and energization.
- The project organization chart including site organization shall also be submitted to the Employer for approval within one month after signing the contract.

b) Subcontractors & manufacturers:

Summary list of the final selected subcontractors/manufacturers shall be submitted for Approval showing materials/equipment, place of manufacturing and testing etc.

The Employer has the right to request the Contactor to submit detailed subcontract (Suborder) documents if required.

c) Specifications:

The Contractor shall prepare specifications for all major equipment/materials, installation, and commissioning for the Employer approval.

The specification shall contain the type, ratings, design, construction, materials, dimensions, corrosion protection and other necessary performance of the equipment.

d) Calculation sheets:

The Contractor shall submit all design calculation sheets for approval required for the substations systems and equipment in accordance with related IEC standards or equivalents, but not limited to:

- i) 132kV/LV cable sizing calculation
- ii) CT/VT ratings and sizing calculation (Burden, Class, Knee point voltage, Secondary resistance etc)
- iii) Batteries and Battery Charger capacity
- iv) Auxiliary Transformer capacity calculation
- v) Earthing system, conductor sizing and safety of personnel and equipment calculations
- vi) Detailed civil structural design calculations.
- vii) Protective Relay settings calculations and recommendations
- viii) Insulation coordination study

)

e) Lists:

The following lists shall be submitted for approval:

- Cable Lists
- List of site installation equipment
- List of Test Equipment and Special Tools.
- List of Spare Parts
- f) Factory Test Time Schedules
- g) Factory Test Procedures
- h) Factory Test Reports with witness signature
- i) Site test time schedule and Procedures
- j) Site Test /Commissioning Report
- k) Operation and maintenance Instruction Manuals and installation manual.
- l) Red marked As-Built Drawings
- m) As-Built Drawings
- n) Monthly Project progress report
- o) Weekly and Daily site report

1.1.3 Required Numbers of Drawings/Documents

Numbers of the documents to be submitted to Engineer shall be as follows:

a) During the Design/ Manufacturing stage:

- Documents for approval : 6 copies.
- Reference documents : 6 copies.

b) Before energizing stage:

- Red mark corrected drawings : 4 copies.

c) After commissioning test:

- Complete sets of bound prints of As-built drawings : 4 copies.

d) After Final Acceptance:

- Complete sets of bound prints of As-built documents : 4 copies.
- CD ROM containing as-built documents : 4 sets as PDF.

1.2 Corresponding Letters

The corresponding letter shall have series letter number, with the date of submission, address, project name, substation name, subject etc.

The project letter numbering system may be instructed by the Employer after the Contract.

2. Drawings and Documents to be submitted with the Bid;

The following drawings/documents shall be submitted with the Bid:

2.1 Typical single line, layout & sectional drawings of substation showing details of construction and dimensions.

2.2 Outline drawings of all switchgear equipment:-

- (a) Showing installed dimensions and weights;
- (b) Showing transport dimensions and weights;

2.3 Outline drawings of all power transformers and auxiliary transformers:-

- (a) Showing installed dimensions and weights;
- (b) Showing transport dimensions and weights;

2.4 Typical drawing of transformer remote control panel.

2.5 Following type test certificates of the equipment of similar or higher specifications (higher voltage & higher capacity) as per relevant IEC with the Bid.

Following type test certificates of the equipment of similar or higher specifications (voltage & capacity) required by the bid shall be submitted as per relevant IEC and shall be from any independent testing laboratory except Power transformer, GIS, circuit breaker and Lightning Arrester.

Type test certificates of Power Transformer, GIS and Lightning Arrester shall be issued by any one of the independent testing laboratories listed below or from manufacturer's own testing laboratory. Test carried out at manufacturer's own testing laboratory must have been witnessed and certified by a representative from the below listed independent testing laboratories.

Short listed independent testing laboratories: -

1. KEMA Laboratories - DNV GL – Netherlands/USA
2. CESI – Italy
3. PEHLA Laboratory– Germany
4. CERDA– France
5. Powertech Laboratories Inc. – USA
6. Hitachi Ltd., High Voltage & High Power Testing Laboratory – Japan

7. Toshiba Corp. Hamakawasaki High Voltage and High Power Testing Laboratory – Japan

8. KERI – Korea

(i) Power Transformer (230kV)

- (a) Temperature rise test.
- (b) Dielectric tests (Induced over voltage test, Lightning impulse voltage withstand test, Separate source voltage withstand test).
- (c) Short circuit withstand test (special test) *.

* short circuit test certificates/reports for 230kV transformer shall be of minimum 220kV, 225MVA three phase inter bus Power Transformer.

(ii) GIS Switchgear

(a) On one Complete Switchgear (for 230 kV)

Sl No	IEC 62271-203 Clause	Test Name
i.	6.2	Dielectric tests:
		- Lightning impulse voltage tests
		- Power-frequency voltage tests
ii.	6.4	Measurement of the resistance of circuits
iii.	6.5	Temperature-rise tests
iv.	6.6	Short-time and peak withstand current tests
v.	6.104	Pressure test on partitions
vi.	6.105	Test under conditions of arcing due to an internal fault
vii.	6.106	Insulator tests

(b) Circuit Breaker (for 230 kV)

Sl No	IEC 62271-203 Clause	Test Name
ii.	6.101	Mechanical and environmental tests
iii.	6.103	Test circuits for short circuit making and breaking tests
iv.	6.108	Single-phase and double-earth fault tests
v.	6.109	Short-line fault tests
vi.	6.110	Out-of-phase making and breaking tests

(c) Disconnecter & Earthing Switch (for 230 kV & 132kV)

Sl No	IEC 62271-203 Clause	Test Name
ii.	6.101	Tests to prove the short-circuit making performance of earthing switches
iii.	6.102	Operating and mechanical endurance tests
iv.	6.106	Bus-transfer current switching tests
v.	6.107	Induced current switching tests

- (d) Current Transformer (for 230 kV)
 - i. Short-time current tests
 - ii. Temperature-rise test
 - iii. Impulse tests on primary winding
- (e) Voltage Transformer (for 230 kV)
 - i. Temperature-rise test
 - ii. Lightning Impulse test
- (f) Gas leakage rate (Per year) (for 230 kV)

(iii) Lightning arrester (AIS)

- (a) Power frequency voltage withstands and lightning impulse voltage withstand tests on complete arrester housing.
- (b) Operating duty test.
- (c) Long duration current impulse withstands test.
- (d) Residual voltage test.
- (e) Pressure relief test.
- (f) Artificial pollution test.

(iv) XLPE Power Cable

- (a) Bending test followed by partial discharge test
- (b) Tan Delta measurement
- (c) Heating cycle voltage test
- (d) Partial discharge tests: At ambient temperature, and At high temperature.
- (e) Switching impulse voltage test
- (f) Lightning impulse voltage test
- (g) Short Circuit Capability Test

(v) Insulator

(a) Post Insulator

- (i) Dry lightning-impulse withstand voltage test
- (ii) Dry or wet switching-impulse withstand voltage tests
- (iii) Dry power-frequency withstand voltage test (Indoor PI)
- (iv) Wet power-frequency withstand voltage test (Outdoor PI)

(b) Disk/String Insulator(On insulator unit)

- (i) Dry lightning impulse voltage withstand test;
- (ii) Wet power frequency voltage withstand test;
- (iii) Electro-mechanical failing load test;
- (iv) Thermal mechanical performance test;

- (v) Impulse voltage puncture test;
- (vi) Power arc test.

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SUBSTATION TO 230kV ON TURNKEY BASIS

SCHEDULE J

**PROPOSED ALTERNATIVE STANDARDS TO WHICH
EQUIPMENT SHALL BE PROVIDED**

The bidder shall list below all the alternative engineering and design Standards, which he proposes to use in his design, manufacture and testing of equipment to be supplied. Should these standards differ from the specified standard in any respect, the bidder shall detail the differences between the proposed and specified standard.

Compliance with any standard equal or superior to those specified will be considered acceptable.

In the absence of any listed alternative standard, it is deemed that the standards specified in the Tender documents are fully complied with.

Specified Standard	Alternative Standard	
	Number	Title